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Improved Tunneling Drill.

In the great engineering enterprises of the day, the operation of blasting is constantly gaining in importance. The vast resources, placed in the hands of engineers by the introduction of explosives of resistless power, have rendered the prosecution of a certain class of work so much more expeditious and cheap than it used to be, that the latter half of the nineteenth century witnesses the triumphant completion of mining and tunneling operations of unprecedented magnitude.

The Mont Cenis and the Hoosac tunnels are undoubtedly only the forerunners of many similar works, some of which may even eclipse in extent and difficulty these two, as yet, unrivaled feats of their kind.

With improvements in explosives has come the demand for improved means of drilling rocks. This has long been the most tedious and expensive operation in mining and tunneling; but, although there have been many attempts to supersede hand drilling by the use of machinery, it is only quite recently that really important successes have been achieved; and at the present time by far the greater part of rock drilling is done in the old way.

The first attempt at increasing the efficiency of drilling tools aimed at the improvement of the quality of the steel of which the points of hand drills are made, but latterly the mechanical world has become familiar with the black diamonds or borts, or—as they are sometimes tautologically called “carbon-diamonds,” of which there is a plentiful supply. In hardness and abrasive power, these borts are rivaled by no other known substance.

The application of this substance to rock cutting has presented many difficulties. One after another these have been surmounted, until, at the present time, there is probably no material that will do as much stone cutting, in proportion to its cost, as these slate colored gems. Without brilliancy or beauty, they have proved to be of far more intrinsic value to mankind than their sparkling and more expensive congeners.

But though their extreme hardness gives them power to cut the hardest materials, they are too brittle to endure percussion. Their action is rather grinding than cutting; they may therefore be advantageously used, set as teeth in metal blades for saws, or to arm the extremities of metal cutting tools and drills, where they are not subjected to blows sufficient to crush them. Tools thus made now constitute a very important addition to the resources of the industrial arts.

For rock drilling, the principle adopted by Leschot, and first put in operation by him, has never been improved upon. His invention consists in the use of an annular ring armed with diamonds, or any other form of head similarly armed, attached to the end of a tube, through which water is forced to keep the drill cool, and to wash out the pulverized rock from the holes, by the regurgitation of the water up around the tube. The machinery employed by Leschot to propel his drill was very imperfect, and the method of fastening the diamonds has been greatly improved since the introduction of

his invention into the United States. The patent for this country has passed from the possession of its first owners, and is now owned by the American Diamond Drill Company, of 61 Liberty street, New York, of which General Charles H. Tompkins is the President.

With the exception of the hollow tube and the diamond drill point, the diamond drilling machines employed by this company are purely American, and have been evolved from the fertile genius of Mr. John North, of this city, an engineer whose ability is well known to the mechanical fraternity.

chine. The screw sleeve, through which the drill rod or tube passes, and which turns with the latter, passes through a nut which can move neither up nor down, but can rotate freely with the screw when not held.

This nut has, on its outer surface, an adjustable friction brake, by which, when the pressure of the latter is adjusted, the revolution of the nut is retarded by a constant force, and this maintains a constant pressure upon the diamond cutter, whether it cuts fast through soft streaks, or slow through hard ones; for the moment the friction of the screw threads in the nut, caused by upward pressure of the drill, in the least exceeds the friction of the brake, the nut turns with the screw, the latter not advancing till the cutters relieve the pressure, and thus, lessening the friction in the nut, allow the brake to act. This action, however, must not be understood to be fitful or intermittent, for, as the cutters act constantly, they as constantly remove the resistance to the advance of the screw. The nut, therefore, keeps turning with the screw, but being less retarded by the action of the brake, the drill feeds down slower when hard streaks increase the upward pressure upon the nut.

It is thus rendered, so to speak, sensitive in its action, never crowding the drill shaft so as to endanger the carbon points, nor checking the revolution of the shaft. When it is desired to run up the drill, the gear which impels the screw sleeve by a spline and slot, is unclutched. The nut is then clutched to a gear which reverses its motion and, revolving it at high speed, quickly withdraws the drill from the hole in the rock.

The motive power may be either steam or compressed air, but for tunneling the latter is far preferable.

The machine illustrated and described has been running at the recent Fair of the American Institute with compressed air, supplied



THE AMERICAN DIAMOND DRILL COMPANY'S No. 2 TUNNELING DRILL.

As best illustrating these machines in their improved form, we place before our readers an engraving of what the company style their No. 2 tunneling drill, which is remarkable for its extreme simplicity and portability, as well as for the most ingenious mechanical movement, by which it is made to automatically adjust its feed, to the varying hardness of the rock to be drilled, while the drilling proceeds. In this movement lies the most interesting and important part of the machine, if we except the diamond cutters, and the hollow tube to which they are attached.

Let the reader take in his hand, or imagine, a plain bolt and its nut. If the nut be held from turning and advancing, the screw will, when turned, advance through the nut. If the screw be held from turning, and the nut be turned in an opposite direction, and still kept from advancing, the screw will be made to retreat. If the screw and the nut turn equally fast in the same direction, there will be neither advance nor retreat of the screw through the nut. If the screw makes one revolution more per minute in one direction than the nut makes in the same direction, then, at the end of the minute, the former will have advanced through the latter a distance equal to the pitch of the screw.

These principles enter into the feed movement of this ma-

chine. The screw sleeve, through which the drill rod or tube passes, and which turns with the latter, passes through a nut which can move neither up nor down, but can rotate freely with the screw when not held.

We saw it cut an inch and a quarter hole through brown sandstone at the rate of 11 inches in 55 seconds.

A large machine (No. 1) cut through a very hard piece of blue limestone at the rate of 4 inches in 3 minutes, the diameter of the hole being about two inches, and the machine running below its proper speed. The framework of the No. 2 drill, as well as that of the other sizes, is adapted to work in headings, and is provided with screw supports, which hold it in any position required; and the drill works, equally well, pointed at any angle with the frame, above or below.

A No. 1 drill is now at work in one of the headings at Hallett's Point, having been purchased by General Newton for use in the extensive tunneling operations for removing the Hell Gate obstructions at that place.

General Newton states that the machine drills, with 60 lbs. air pressure, a total of twenty feet penetration in eight hours, and that it has more than fulfilled the conditions under which it was purchased. It is probable that others will be purchased and used on this work as the efficiency of the drill, in penetrating this excessively hard rock, is more fully demonstrated.

It is stated that, at Pottsville, a machine of this kind made a perpendicular bore of 751 feet, and at Schuylkill, Pa., another made a horizontal penetration of 680 feet. The depth can be extended within any practical limit by simply joining on lengths of tubing.

We learn from an authentic source that the committee of the department in which this drill was exhibited, in the recent Fair of the American Institute, have made a highly favorable report in regard to its merits.

The above named company is, we understand, prepared not only to supply these machines, but to execute rock drilling and excavations under contract, and to employ their prospecting drills for obtaining test cores in the geological surveys of mineral lands.

ELECTRICITY AT THE AMERICAN INSTITUTE EXHIBITION.

The electrical apparatus of various kinds on exhibition at the Fair forms one of its most prominent and interesting features. It is much to be regretted, however, that instead of being classified in a group by themselves—a distinction which is certainly warranted by the present and prospective importance of electricity and its applications—the different entries of this class are scattered through half a dozen different departments, and placed in as many different parts of the exhibition, so that it is a matter of difficulty to find some of them at all. For instance, one electrical burglar alarm is placed in the Department of Intercommunication, and another, of precisely the same general character, is placed in the Department of the Dwelling. It would be difficult to imagine upon what principle such a classification as this is made. Other instances of a similar character might be mentioned. It is much to be desired that this defect may be remedied in future exhibitions.

MAMMOTH INDUCTION COIL.

The most interesting piece of electrical apparatus on exhibition this year is unquestionably the mammoth induction coil (misnamed Rhumkorff's), belonging to the Stevens Institute of Technology, of Hoboken, N. J., and which is the largest and most powerful apparatus of this kind which has ever been constructed. Its length is 40 inches, diameter 18½ inches, and it weighs 166½ pounds. The primary wire is 200 feet long, while the secondary is 234,100 feet, or about 44½ miles in length, of No. 34 wire. It is worked by a battery of fifteen pairs of zinc and carbon plates, 6 x 9 inches, which are lowered at pleasure, by means of a windlass, into three large glass jars containing a solution of bichromate of potash and sulphuric acid, made in the customary proportions.

With the above battery in good condition, the coil freely throws sparks through the air twenty-one inches in length by actual measurement, and a piece of glass is shown, three inches thick, which has been perforated by the spark, leaving an irregular crystalline looking track. This exceeds any performance of an induction coil on record.

This apparatus was constructed by Mr. E. S. Ritchie, of Boston, whose instruments and apparatus of this kind are confessedly superior to those of any other maker in the world. The SCIENTIFIC AMERICAN states that, a few years since, Professor McCullough carried a large coil of Ritchie's manufacture, belonging to Columbia College, to Paris, and showed it to Rhumkorff, who was so much astonished at its superiority over anything he had ever constructed himself, that he asked permission to dissect it. This permission was granted, and he found that Ritchie's insulation and mode of winding the wire was far superior to his own, and he has since adopted it in his own practice. The exhibition of these enormous sparks, and the beautiful coronations of the Geissler tubes, connected with the apparatus, are highly suggestive of chain and sheet lightning, and never fail to attract a large crowd of astonished and delighted visitors.

Just back of this apparatus, near the entrance of the art gallery, may be seen a fine Thomson's reflecting galvanometer, such as is employed in working the ocean cables. This is also the property of the Stevens Institute.

MONSTER ELECTROMAGNET.

Down stairs, at the right of the entrance to the exhibition building, may be seen the monster electromagnet which was constructed by Mr. Wallace, of Ansonia, for Professor Henry Morton, of the Stevens Institute. It consists of eight metallic spools, twenty-one and a half inches in diameter by nine and a quarter inches long, surrounded by coils of copper wire insulated with kerite. It is wound in 272 convolutions around each spool—2,176 in all. The spools are of metal, and are, of course, made hollow, to permit the passage of the cores. The latter are of the best Norway iron, thoroughly decarbonized, two in number, three feet three inches long, six inches in diameter, each weighing 183 pounds. They are suspended from a cross bar or back strap, whose cross section is that of said cores, being two feet four inches long, twelve inches wide, two inches thick, and weighing 180 pounds. The spools are slipped four upon each core, and held firmly in position by nuts upon the under side. The wire is wound separately upon each spool, and connected by binding screws passing through hard rubber insulating bands, fastened upon the flanges, so that the power of each spool can be developed separately, or the whole connected in series. The armature consists of a piece of soft iron, twenty-three inches long, five inches wide, and one and three quarter inches deep, and weighs fifty-four pounds. Through its centre passes a massive eye-bolt, to which can be attached the weight it is desired to lift. Its total weight is about 600 pounds. This is nearly twelve times as heavy as the celebrated magnet constructed by Professor Henry, of the Smithsonian Institute at Washington. Professor Mayer has estimated its lift-

ing force at between thirty and fifty tons! or nearly five times as powerful as that used by Professors Faraday and Tyndall in their famous researches and experiments.

Professor Mayer, of the Stevens Institute, exhibits some very fine photographs, showing the lines of magnetic force, which are of great interest to students of electrical and magnetic action.

ELECTROMAGNETIC LOCOMOTIVE.

Emile Prevost shows an electromagnetic locomotive, weighing about a pound, which continually travels around a miniature circular railway about three or four feet in diameter, the battery being connected with the rails. It is nothing more than an amusing toy, although the inventor makes the preposterous claim that, with similar but more powerful mechanism, he can develop two horse power from two cups of battery; an assertion entirely outrivalling anything we have yet had, even from our friends Paine, Highton and Reid.

NEW GALVANIC BATTERY.

Mr. Prevost also shows a new form of galvanic battery, in which the porous cell is formed of carbon. It is charged with dilute sulphuric acid in the outer cell, and with a new solution, invented by Victor Barjon, in the inner cell. This solution is the ordinary bichromate of potash and sulphuric acid, with the addition of some other chemical, which, it is claimed, increases its enduring properties very greatly. Tests which have been made with it show that, beyond question, it is a very superior form of battery, although how much of this superiority is owing to the arrangement of the elements, and how much to the peculiar solution used, has not, as far as we know, yet been definitely determined. Experiments are now being made with it.

NOVEL BURGLAR ALARM.

W. B. Guernsey, of Jersey City, N. J., shows a burglar alarm on a somewhat new principle, combining a closed main circuit with an open alarm circuit, the whole being so arranged that a break or short circuit in the main circuit will sound the alarm, so that the apparatus protects itself as well as the building in which it is placed.

ELECTRIC SEWING MACHINES.

E. Gaume, of New York, shows an elliptic sewing machine driven by an electromotor, consisting of six large, fixed electromagnets encircled by a revolving metallic ring carrying the armatures. The power is derived from four eight inch Bunsen cells, which seem to be amply sufficient to do the work. The arrangement of the motor itself shows no particular novelty.

Solomon Jones, of New Orleans, also has an electro-motor, for sewing machines, consisting of a vibrating bar carrying two armatures, and moving between the poles of two large electromagnets. This is driven by four large bichromate cells, and appears to move with considerable power. The arrangement of the mechanism is, however, awkward and unscientific, and a great part of the power produced is consumed in changing the motion of the heavy vibrating bar twice during every revolution of the main shaft. From a circular of a curiously illiterate character, which was presented to us, we learned that horse cars and machinery are to be driven by the new power, provided it turns out to answer the purpose, which we rather think it won't. As we heard an elderly countryman remark, when he saw it, "What would Ben. Franklin a' think o' this?"—*Telegrapher*.

TRIAL OF FIRE ARMS.

A military Board of Officers of the State of New York has lately had occasion to make a competitive test of various improved fire arms, with a view to the adoption of the best arms for the service of the state militia.

After careful examination and full explanation by the exhibitors of the various arms submitted, the Board selected from among them those which, in their opinion, were best adapted for use, and caused circulars to be sent to the owners, asking proposals to furnish the State with 15,000 new arms of their respective models, and to receive an equal number of the Springfield rifle muskets, calibre 58, now in the hands of the National Guard, at such price as might be deemed favorable, in part payment therefor.

Proposals were received from the owners or representatives of the following guns:

The Remington, the Springfield, the Ward-Burton, the Conroy, the Brown, the Whitney, the Joslyn-Tomes, the Peabody.

The proposals were as follows:

Gun	Cost of new arms.	Allowance for old arms.	Net cost.
Remington.....	\$18 00	\$5 50	\$12 50
Springfield (Allen).....	19 00	5 00	14 00
Conroy.....	19 00	3 00	16 00
Brown.....	21 25	5 00	16 25
Ward-Burton.....	18 75	2 10	16 65
Peabody.....	17 00	1 00	16 00
Whitney.....	21 00	5 00	16 00
Joslyn-Tomes.....	21 00	1 00	20 00

The test of the guns took place during the latter part of September at Springfield, Mass. The salt water test was made in New York City.

The representatives of the arms tested were afforded every opportunity to display the merits of their respective systems, to point out the alleged defects of competing guns, and to demonstrate, by actual test, the superiority claimed for each in any particular.

The experiments resulted satisfactorily, and demonstrated that all the arms possess great merit in point of accuracy, durability and facility of manipulation. In fact, were the choice of an arm to be determined by the actual result of the experiments upon the arms themselves, the Board would have great difficulty in arriving at a decision, all the arms

having undergone the various tests without injury, and unexceptionally to the satisfaction of the Board.

In arriving at the recommendation, embodied in this report, the Board considered, primarily, the relative merits of the various systems presented as regards strength, durability, accuracy, and simplicity of mechanism, and liability to accident in the hands of the troops who might be comparatively inexperienced in the use of arms; secondarily, economy, rendered necessary by the limitation of the appropriation for their purchase, and, in view of the urgent necessity for the immediate procurement of breech loaders for the National Guard, the ability to furnish the requisite number within a short time.

The Board recommended, unanimously, the adoption of the Remington rifle musket, of the improved model manufactured for and submitted to this Board, (loading at assimilated half-cock, locking the breech piece in the loading, withdrawing the firing pin by a positive motion, and ejecting the shell on opening the breech), as the best arm, in all respects, for the use of the National Guard of the State of New York.

In order to make it conform to the calibre used by the United States Government, the Board commenced the adoption of the 50-100 calibre, although, but for this consideration, and as an independent proposition, they would prefer the 43-1000 calibre.

The Board consider the Springfield, Peabody and Ward-Burton guns especially worthy of attention and consideration. They all possess great merit, and are of undoubted excellence.

The Governor of New York having accepted the report, the militia will soon be supplied with the Remington gun. This will probably defeat the plans of the members of the notorious Ring of New York city, who had arranged a scheme for the robbery of the State treasury, by foisting an inferior arm upon the militia, at an exorbitant price.

It may be of interest to append the result of the tests with the accepted rifle. They were as follows:

REMINGTON—CALIBRE 50, WITH EXTRACTOR AND LOCKING DEVICE.

Rapidity of fire—First trial, 14 shots in one minute; second trial, 16 shots in one minute; third trial, 16 shots in one minute; (Berdan cartridges.)

EFFECTS OF SAND AND DUST.

After last sanding, the arm worked stiff for one or two shots, otherwise the gun worked well; no perceptible injury to breech mechanism.

EFFECTS OF DEFECTIVE AMMUNITION.

No discharge of gas until the sixth cartridge, was fired, which then was sufficient to slightly cloud a piece of white paper placed over the breech block during the firing; no perceptible injury to mechanism.

EFFECTS OF SALT WATER.

On attempting to fire the first cartridge, it was discovered that the firing was broken. A new pin was put in place, and the gun again placed in salt water and exposed in the open air the prescribed time. The piece was then fired, working rather stiff, and the extractor failed to throw out five or six shells.

SIMPLICITY OF CONSTRUCTION.

The piece was dismounted and found to be uninjured by the several tests. It was dismounted in fifteen seconds, and assembled in fifty-nine seconds.

Two other Remington guns were presented to the Board; one without locking device or extractor, cal. 43 (Spanish gun); the other with locking device differing from the one first mentioned in the report. These arms were not subjected to all the tests, but such trial as was made of them proved that they withstood the tests equally well with the arm favorably reported.

The target record of the Remington, calibre 50, at 100 yards range, showed, the center of impact from center of target was 4-34 inches, with an absolute deviation of 4-58; at 300 yards, with the same arm, the center of impact was 12-53, absolute deviation 7-1; at 700 yards, the center of impact was 27-11, the balls carrying to the right. At 100 hundred yards with the Springfield B. I. R. model of 1868, calibre 50, at 100 yards, the center of impact was 5-06, most of the balls going to the right; at 300 yards, center of impact was 4-2; at 700 yards the center of impact was 55-46, all of the balls going to the extreme right of the target.

With the Ward-Burton with Springfield barrel, the center of impact was 10-66 at 100 yards, at 300 yards, 2-65, at 700 yards, 66-18.

With the Peabody, cal. 43, at 100 yards, the center of impact was 1-12, at 300 yards 11-04, at 700 yards 40-79. With the Winchester, at 100 yards, the center of impact was 6-54, nearly all the balls going up to the upper right portion of the target. With the Remington, cal. 42 at 100 yards, the center of impact was 14-8, all the balls being splendid line shots and placed in the lower portion of the target below the bull's eye. With the Remington, cal. 42, at 700 yards the center of impact was 17-55.

ONLY a few days before the great fire, the President of one of the largest of the English insurance companies (the Imperial, of London) was in Chicago, with a view of establishing an agency there; but he was so impressed with the precariousness of the situation that he declined to yield to the temptation. "I cannot do it," said he; "you have some fine buildings, but you have them surrounded by very bad ones. The first time circumstances combine against you, your whole city will burn up." This experienced underwriter had hardly time to get out of the country before his prediction was terribly verified.

MAMMOTH CAVE AND HOW IT WAS MADE.

By Professor E. D. Eaton, in the Beloit College Monthly.

You know how, in the early dawn of the world's history, the shape of our continent was fixed by a long island which raised itself from the waters like a man's arm, with its elbow in the State of Wisconsin and pointing to the northward, east and west. The initial plan was developed by a symmetrical growth in the same shape to the south and to the north, till, before even the medieval time, the southern coast line was where now is the state of Kentucky. The rivers continued cutting into the land and bearing its ruins to the sea. Along the coast, the sweeping currents of the of the tireless ocean were spreading this sand upon the sea bottom, and, as the years crept on, there grew a thicker and a thicker bed of sand over all that region. Should you go there now, you would find it a solid sandstone, hundreds of feet below the surface of the present dry land.

After this great accumulation of rock material, the direction of progress changes. The ocean is now to advance upon its old territory, and the land sinks slowly, inch by inch, and century by century, before the advancing waves. The waters have been too impure with all this sediment, and too shallow and too fresh, for the delicate, cleanly, salt loving corals to make them their home. But as the waters grow deeper and purer, they come, migrating slowly from other regions, as the trees spread on our prairies from the knolls, adapting themselves, as they come, to their new habitat by various modifications. And, finally, over the land is a garden of sea-lilies and corals. These lilies and these corals are of stone and the waves beat them to pieces and grind them to a powder, till the sandstone is covered with their ruins and lies two hundred feet and more below this new bed of limestone.

Then, again, the land rises, and step by step the waters fall away and the inhabitants of the ocean retreat, till in the place of the beauty and the life of the crinoidal sea with its white lily buds, is again a dreary waste of sand, and the limestone lies firmly bound like a book in its covers, between two thick and solid layers of sandstone. As the land continues to rise, the waters continue their retreat to the southward, and today the Kentucky subcarboniferous limestone is five hundred miles from the girdle of the ocean. The cave is in the St. Louis stratum.

Nature's work never lasts. Though the limestone was buried, it was not secured against further change. Through fissures and through the porous sandstone, the fresh water containing carbonic acid finds its way and begins to dissolve it grain by grain. This work may have begun as long ago as the coal time. Very slowly at first the crevices are enlarged, in places distant from each other. During the centuries, they are widened and deepened and opened into each other; and at length there is a subterranean river dissolving the rocks, or more properly there is a river system with its main stream and its tributaries, fed by springs and infiltrating water from the rocks above. There are doubtless hundreds of miles of these caves in the limestones of Kentucky, forming a complete network of ancient river channels.

Our preconceived idea of Mammoth Cave, formed no doubt from the Raphaelitic picture, that used to look at us from the geography of our youthful days, was of immense chambers of rounded proportions, where the glittering stalactites hung from the ceiling in boundless profusion, and we met half way by equally white stalagmites. Put a cover on the Dells of the Wisconsin, remembering that the erosion of sandstone forms a different channel from that solution of limestone, and the result is an enlarged copy of Mammoth Cave.

A few weeks ago, in the early morning, a party of twenty, comprising the State geologists of half a dozen States, from Michigan to Mississippi, and geologists and naturalists from as many more; one who had been with Powell in Colorado, one who had been in the Brazilian jungles with Agassiz, not a few who had climbed the Alps, all stood with their loins girt about, their staves in their hands, and their lamps trimmed and burning, looking down a long slope into a dismal hole in the ground. We had broken through the autocratic rule that is wont to govern cave parties, for, by special permission of the attorney and agent of the owners of the cave, who showed a becoming respect for such an array of science, we formed ourselves into a democracy, and our guide was to obey the expressed will of the majority.

Passing beneath the thin cloud of mist which lay on a level with the external surface, and is caused in summer by the meeting of the cold air of the cave with the warm external air, and noting the juncture of the sandstone above with the limestone, we answered, each one, to our names, and passed the gate, and so left behind us those circumstances of nature which, more than any other, have come to be a part of one's earthly existence. The darkness and the silence are perfect, save, now and then, the falling of a drop of water, or the flickering of a lamp. Here is no morning and no evening, only simple time, undivided. Here is no summer and no winter. The temperature is always fifty-nine degrees. Here is no sound, not even the hum of the insect world. For the few species of insects that live in the cave are not those of the exterior world, but sit, white and voiceless, in the gloomy silence. The fragrance of the flowers and the thousand odors of the world of light and motion are wanting here. In their place is an almost perceptible nothingness. In a word, it is a cosmos. It is like our world, and it is unlike it. The drop of water falls, for the law of attraction is the same as in the world above, and, dropping, it wears away the rock. The animal lives upon the fungus, and, dying, leaves its mineral matter, to which the next link of the unbroken chain comes in the same order as before. But we seemed like visitors from another sphere, to whom all this order of nature was new.

The route chosen was a tortuous channel, which is sometimes of great size, and in other parts its narrowness and lowness are well expressed by such names as Fat Man's Misery and Valley of Humility. Resemblances to various objects have given names to many parts. The Giant's Coffin is a huge rock forty feet in length and eight in depth, with most perfect proportions when seen from a certain point, while a band of black runa symmetrically around it. The chamber where this unknown giant lies is some fifty feet high and a little wider. On the ceiling, somewhat incongruously, is the perfect figure of an immense eater, formed by some coloring matter in the limestone. Side passages explored and unexplored lead off in all directions into new mysteries, or perhaps terminate in deep chasms. Through one such crevice in the side came quite a breath of air, indicating an unknown opening.

One might almost think he had descended into the world of an ancient mythology, for after crossing the river Styx, not by the orthodox ferry, but by a natural bridge with a span of one hundred and fifty yards, he comes to an expansion of the cave where, ninety feet below the roof, are gathered the clear waters of Lake Lethe. As we were stepping from the boats upon the further shore, the shades,—they were a band of negro minstrels—that the Lethian waters might not bring forgetfulness of our earthly existence, struck up a variety of very non-elysian airs. Wading waist deep in the cold water, dragging it with a seine for blind fish, was an additional reminder that we were still in the flesh. And so the mythologies are dissipated.

Beyond is Echo River. It traverses the length of the cave more than half a mile; above, the solid arch of rock; below, the waters lapping the boat; around, visible darkness. But by kindling, upon the stern of the boat, red and green fires, with an abundance of magnesium ribbon, the dark tunnel became brilliant with its illumination, and, as we floated

"As idle as a painted ship
Upon a painted ocean,"

the musical voice of the guide, now on high notes, now in a deep bass, was answered by echos which grew slowly fainter as they seemed retreating from us into the recesses of the cave.

The bodies of water within are connected with each other and with Green River outside. A large freshet in this river causes a rise of water in the cave of more than twenty feet, flooding the lower parts, and cutting off all communication beyond Echo River. As Green River gradually wears into its bed and finds a lower level, the waters of the cave sink equally. They are simply the remainders of the river that at some former time traversed the cave. The direction in which the waters ran can be seen from the arrangement of the gravel and finer material on the bottom of the portions now dry. Wherever the waters were in more rapid motion, from an inclination or previous damming by obstructions or narrowness of passage, the gravel comes first, then the finer sand, and last the impalpable sediment. This gravel consists of foreign quartzose pebbles, which were brought in from the surface when the large streams from the melting glaciers rolled the drift material before them.

It was in this part of the trip that the power of scientific enthusiasm over mere emotion was strikingly illustrated. All along the party kept quite scattered, for, in the interests of the naturalists, all were diligently engaged in searching for every trace of animal life. Every promising cranny was peered into with the dim light of a small lamp, and the bright light of a scientific expectation of finding something; every stone which gave the prospect of discovery was turned over, and the cry, which more than any other rang through the cave that day, was this: "Quick! Come here! Here is a new bug!" And the cork of the alcohol bottle would be speedily taken out, and in would go another contribution to science. Thus, by straggling, those in the rear were often obliged to make good speed in order not to lose the party. Such an event is said to be a very serious thing. Lost in the perfect silence, with only a faint light, and that soon extinguished in the anxiety, anxiety grows to terror, and, even before the guide can find the lost one, reason is already gone. When some distance beyond the river, it was apparent that some one was missing—only eighteen could be counted. The roll had been given to the porter at the gate, and no one could tell who it was. An inquiry after the man with a seal-skin coat proved his absence, and there was still another. We demurred about going back for them, for another party was behind us, who would find them, and, besides, we thought, naturalists are generally considered insane, even when in their normal state of mind; there can be no danger of their minds being effected. But, even in a democracy, some one always seizes the scepter, and the guide, soberly shaking his head, said they must be found. So, while we turned the more diligently to our work, he retraced his steps, and, in a little less than an hour, returned with the truants and with a non-plussed comical look in the corner of his eyes, as if he had discovered a new genus *homo*. He had found them the other side the river, gazing intently into the waters of Lake Lethe. They had seen a crawfish, and, in attempting to catch it, had muddled the water. So, with a true scientific patience, they had taken their position on the banks, waiting for the waters to become clear; and as they held up to our view the dejected articulate, they cried, "We didn't know but that we should get lost, but we've got the crawfish."

The only undescribed animals discovered were a new centipede and the probable food of the blind fish, an active little blind crustacean, which two of the party brought up from a clear pool they found in a cavernous recess a hundred feet down a fissure.

The following is the list of animals secured, according to Cope, fourteen species:

ARTICULATA.

- | | |
|--------------------------|--|
| a. Insects. | b. Arachnida, (spiders). |
| 1. Acanthosoma Telamoni. | 9. Opilio-like. |
| 2. Beetle, No. 2. | 10. Aranea-like. |
| 3. Centipede, No. 2. | 11. Myriopoda. |
| 4. Phalangopsis, No. 1. | 12. Psocotremia-like. |
| 5. Phalangopsis, No. 2. | 13. Crustacea. |
| 6. Fly, No. 1. | 14. Astacus (blind crawfish). |
| 7. Fly, No. 2. | 15. Astacus with eyes. |
| 8. Ephemera—larva-like. | 16. Grammys-like (food of the blind fish). |

The zoological facts of the cave, in their bearing upon the succession of life, are perhaps the most interesting of all. By the connection with the exterior river, various animals in limited numbers find their way in. But what becomes of them? They gradually lose their color, and, in the course of a few generations, even their eyes. For a zealous evolutionist, looking for an actual development of a new species from an old one in living animals, effected by the sum of its material surroundings, here is the fact in all its transitional steps. First, a little membrane grows over the eye. But there is still a slight opening. In the next generation this may be entirely closed, but the organ is still there. Let the fish out into the sunlight, and their descendants would have the veil drawn aside from the perfect eye. But on the other hand, examine its descendants whose home is the cave. The eye itself is gone, only a little black pigment is in its place, but the optic nerve is there. Is there doubt even that, if these fishes were brought under the circumstance of light, this rudimentary organ would be developed into a perfect seeing eye in the course of a few generations by direct descent? These are the facts of the anatomy of these fishes in all their stages.

In the last mile or two, appear the gypsum stalactite formations. From the presence of oxidizing iron pyrites, sulphuric acid is formed, which changes the limestone into gypsum. This sweats slowly out of the rock, and, taking the moisture from the cave for its water of crystallization, makes it in this part dry and dusty. The fibers, being fastened around the edges of elevations, are rolled outwards by their growth. This efflorescence, in the form of satin spar, lines the ceiling and walls with alabaster flowers of indescribable beauty. "The Last Rose of Summer" is eight inches across, with curling petals of snowy satin whiteness. All along, the walls are covered with sheets of the glittering lining, with flower like forms of various kinds.

A few minutes further and we are at the end, nine miles from the mouth,—the guide says. Here is one place where the water found a lower exit. It is a well of very generous diameter, sinking vertically into the rock, called the Maelstrom. The guide lights a piece of paper and drops it in. It goes circling down and down till the darkness almost closes over it above, and it is still burning there at the bottom one hundred and seventy below. From the bottom radiate other passages. It goes down through all the limestone layers to the sandstone below, and the roof of the dome above is a layer of the upper sandstone. What a magnificent geological section! We make such everywhere in imagination, but here is one already in the rock itself. A phenomenon the reverse of this, but produced by a similar cause, was visited on the way back. It was Mammoth Dome, where the dripping waters have come in from a small crevice above and made an excavation which is roofed over, and in whose bottom we stood, after climbing down some forty feet. With a floor nearly one hundred feet in diameter, it arched above us two hundred and fifty feet, with fluted columns on the side, tier after tier. The remnant of our colored light and magnesium wire was offered as incense in this temple, and as it was filled with the rosy light, drops of water hung from the roof and fell like liquid diamonds, followers of millions that had dropped before, workers in the darkness.

So, after an absence of thirteen hours, without a thought of weariness, so invigorating had been the cave air, we climbed the slope at the entrance, and came once more into the world of odors. It was nine o'clock in the evening, and light enough to see the trees. It had been raining, and everything was covered with drops of water. "It is like the Brazilian forests," said one. An indescribable aroma was in all the air. It was simply the odor of the leaves and of the grass, and of all the vegetation. Doubtless it is always there; but it soon faded away.

Is it always so, that we only appreciate the beautiful, as we come up into it from below?

Manufacture of Sulphuric Acid.

The manufacture of sulphuric acid is based on the oxidation of the sulphurous anhydride by the oxygen of the air, and the oxidation is obtained by the aid of nitric acid. According to the theory generally admitted, it should be possible to prepare any quantity of sulphuric acid by means of the same quantity of nitric acid. But the results obtained in practice do not always realise the promises of theory, and in some cases the loss of nitric acid is much greater than calculated, for large operations. Mr. P. W. Hoffman, director of a manufactory at Dieuze, has been making experiments to discover the cause of this abnormal result, and has found that by the action of the sulphurous anhydride on the sulphuric acid, containing nitric acid diluted with the necessary quantity of water, so as to mark 50° by the aerometer of Baumé, azote, or what comes to the same thing for the manufacturer, protoxide of azote, is produced. But with a compound of the two acids, marking 58° to 60°, this reaction does not take place. Mr. Hoffman has utilized these observations in his manufacture, and by regulating the entrance of steam in the first leaden chamber (drum), in such a way as to produce acid at 60°, he succeeds in economising 2 lbs. of nitric acid for each 200 lbs. of sulphur consumed.

EACH one is the son of his own works.

THE HUMBOLDT MONUMENT.

We are indebted for the accompanying engraving, and the substance of this sketch, to the *People's Monthly*, a new periodical published in Pittsburgh, Pa., by McKnight, Lowry & Co. It is a popular illustrated publication, the aim of which is to supply good, healthy reading to the working classes in and around that great manufacturing center. In these times, when so much moral poison is issued, in an enticing form and displayed in gaudy colors, from all our news stands, a paper like this, unexceptionable in manner and matter, yet still attractive enough to draw many away from that which can only injure, is worthy of commendation, and we take this occasion to say a hearty word of good cheer to its publishers.

The engraving is that of the beautiful and elaborate monument erected in the North Park, Allegheny, opposite Pittsburgh, to the memory of the great philosopher, *savant*, and statesman, Alexander von Humboldt. The history of the memorial is this: A number of liberal minded German citizens, animated by a praiseworthy motive, conceived the project of erecting a monument which should be at once an ornament to the North Park, and a suitable recognition of the life and services of the eminent philosopher. Once started, the idea was never permitted to slumber. The determined resolution, which enters so largely into the German

composition, was manifested in the matter from the moment the scheme was first conceived. A series of concerts and *tableaux*, projected and conducted by the Turner of Pittsburgh, yielded sufficient funds to encourage the originators of the monumental project in the prosecution of their self imposed task. The citizens of Pittsburgh generally responded promptly to the call for subsequent subscriptions. Several large subscriptions were made by citizens residing in the immediate vicinity of the monument. Thus the success of the scheme was assured.

A committee on erection was appointed in due season, composed of the following named gentlemen: Chairmen, Charles Meyran, Joseph Abel, Joseph G. Siebenack, Major T. Brent Swearingen, Major Gustave Schleiter, Wilson King; Treasurer, Aug. Hartje. The committee at once solicited designs and proposals. Among those submitted, the design furnished by Edward Morganroth, of Pittsburgh, elicited the warmest approval from the members of the committee. Those familiar with the attractions of North Park will agree that a happier selection could not have been made.

The corner stone was laid Sept. 14, 1869, (the centennial birth day of Baron von Humboldt); the attending ceremonies, which were conducted by the Masonic fraternity, being unusually imposing and impressive, the various civil and military associations vying with each other in the desire to honor

the memory of the author of "Cosmos." Subsequently, the President of the United States, in company with a number of distinguished men, attended the festival which succeeded the unveiling and presentation of the monument to the Park Commission.

The structure is composed of a massive pedestal, placed in the centre of a circular basin. The pedestal is of the composite order, the corners being richly ornamented with dolphins, while the base is relieved by animals' heads in life size. Four richly designed pedestals, each surmounted by a large and small basin, are placed opposite the corners of the main pedestal. The single word "Humboldt" stands out in bold relief upon the southeast side of the pedestal. In line with it, on the south side, are the figures "1769," while the north side bears the date "1869." A massive bronze bust, designed by Prof. Gustave Blaeser, of Berlin, and cast at Hanover, surmounts the pedestal. The execution displayed in the modeling of the bust is the admiration of all who are in any manner conversant with art. The sculptor has reproduced, with consummate skill, the expression of the original. Good will and kindness beam from every lineament of the majestic countenance. The entire composition, which is constructed of sandstone, is so simple that its details may be taken in at a glance. It is the chief attraction of North Park. The total cost was \$10,000.



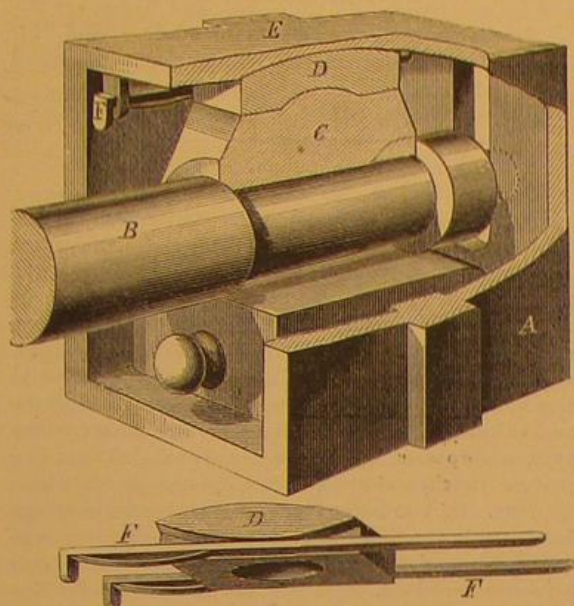
THE HUMBOLDT MONUMENT AT ALLEGHENY CITY PA.

WILLIAMS' IMPROVED AXLE BOX FOR RAILWAY CARS.

The inventor of this improvement maintains that boxes, made to accommodate themselves to the varying positions of journals of railway axles and properly lubricated, would practically prevent heating when running at high speeds. He has, therefore, constructed the box illustrated in the annexed engraving, with a view to bring about this accommodation of parts.

In the engraving, A represents the housing, B the axle, and C the box.

Between the box, C, and the cap, E, is placed a plate, D. This plate has on its under side a cavity which is of the form of a portion of a sphere, into which fits a convexity of corresponding form on the top of the box. This allows the box to move with the axle in all the horizontal movements of the latter.



The plate, D, has on its upper surface a longitudinal circular convexity, fitting into a corresponding concavity in the cap, E. This arrangement permits the box to play so as to adapt itself to all inclinations of the axle from the horizontal plane.

F represents spring slides placed in rebates formed in the sides of the plate, D, which serve to hold the plate up and in place when the box, C, is taken out or put in.

There is no doubt that the use of such boxes would greatly lessen the friction of journals and their consequent liability to heat, if indeed it would not totally prevent the latter difficulty, when used in conjunction with good oil.

The improvement was patented, through the Scientific American Patent Agency, by Christopher Williams, Oct. 31, 1871, whom address, for further information, at Adrian, Mich.

A Queer Fireproof Vault.

According to the *Chicago Tribune*, some extraordinary revelations have been made, by the fire, with regard to the architecture of the post office and custom house building, which, proving to have been a sham and a fraud of the worst kind, has involved the loss of an immense sum of money.

The vault in the Sub-Treasury office, in which Collector McClean had deposited all the funds pertaining to his department, was built upon the second story. It rested upon two iron pillars, built from the basement, with two iron girders, of great strength and weight, connected with the wall. A third girder connected the two pillars, forming a framework. A heavy fireproof vault was built upon this foundation, and proved to be about the weakest in the city in resisting the fierceness of the fire. There were in the vault, at the time of the fire, \$1,500,000 in greenbacks, \$300,000 in national bank notes, \$225,000 in gold, and \$5,000 in silver, making a total of \$2,030,000, of which \$300,000 was in specie.

In an old iron safe, which was left outside the vault, was deposited \$35,000, consisting of mutilated bills and fractional currency. This safe was regarded with scorn and deemed unworthy a place in the vault. But, like the little fishes in the net, its insignificance saved it. When the building caught fire and blazed with fervent heat, the miserable iron pillars melted, and the immense vault, with the fabulous treasures, fell to the basement, burying the insignificant safe and its mutilated contents. The consequence was that the contents of the latter were saved, while \$1,800,000 in currency was burned to powder, and hopelessly lost.

The specie was scattered over the basement floor, and fused with the heat. There were lumps of fused eagles, valued at from \$500 to \$1,000, blackened and burned, but nevertheless good as refined gold. The employees have been compelled to rake the ruins of the whole building, and have recovered, altogether, about five sixths of the whole amount. It is probable that days will pass before they are able to find the remainder.

It is a fortunate circumstance that, only a week ago, \$500,000 in gold and \$25,000 in silver had been shipped from the city.

The building was, as before stated, a fraud of the most barefaced description, and consequently an everlasting disgrace to the country. That a vault, containing treasure to the amount actually lost, should be supported only on two iron pillars, which gave way and let it fall in ruins, and should yet make a boast of being fireproof, is a piece of irony the most acute.

But this vault was only one of the frauds. The fireproof doors of the post office vault, in which were stored the records, proved frail still. The hinges, of the massive port-

als which were to protect the Government records, were only affixed to a single brick. When, therefore, the walls expanded with the heat, the sturdy doors fell out of their own weight, each hinge carrying with it the single brick to which it held, while the remainder of the wall was as firm as possible. Of course all the record were hopelessly ruined.

This vault was fire and burglar proof. Experts are not the only persons who can judge of the value of a vault whose doors had such a feeble hold.

The building is one of a large number built on the same plan, and the condition of the lower vault suggests great weakness in those erected in other cities. It is probable that the Government will order an inspection of all existing vaults.

It is ascertained that no stone ever used in the business part of the city is worth a farthing in such a fire. Brick is the only thing that comes out whole, and is ready to try it again. The future Chicago will be a city of bricks.

AN EXPLOSION ON THE SUN.

(Communicated, by Prof. C. A. Young, to the Boston Journal of Chemistry)

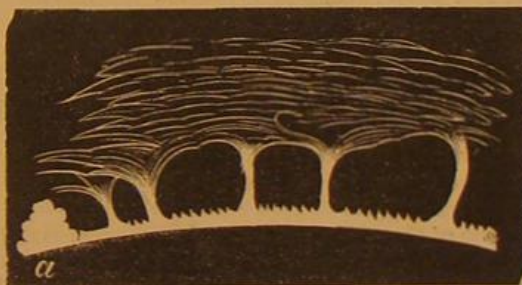
On the 7th of September, between half past twelve and two P. M., there occurred an outburst of solar energy remarkable for its suddenness and violence. Just at noon the writer had been examining with the telespectroscope* an enormous protuberance, or hydrogen cloud, on the eastern limb of the sun.

It had remained with very little change since the preceding noon—a long, low, quiet looking cloud, not very dense or brilliant, nor in any way remarkable except for its size. It was made up mostly of filaments nearly horizontal, and floated above the chromosphere†, with its lower surface at a height of some 15,000 miles; but was connected to it, as is usually the case, by three or four vertical columns brighter and more active than the rest. Lockyer compares such masses to a banyan grove. In length it measures 3' 45", and in elevation about 2' to its upper surface—that is, since at the sun's distance 1" equals 456 miles nearly, it was about 100,000 miles long by 54,000 high.

At 12:30, when I was called away for a few minutes, there was no indication of what was about to happen, except that one of the connecting stems at the southern extremity of the cloud had grown considerably brighter, and was curiously bent to one side; and, near the base of another at the northern end, a little brilliant lump had developed itself, shaped much like a summer thunder head.

Fig. 1 represents the prominence at this time, *a* being the little thunder head.

FIG. 1.



What was my surprise, then, on returning in less than half an hour (at 12:55), to find that in the meantime the whole thing had been literally blown to shreds by some inconceivable up-rush from beneath. In place of the quiet cloud I had left, the air, if I may use the expression, was filled with flying debris—a mass of detached vertical fusiform filaments, each from 16" to 30" long by 2" or 3" wide, brighter and closer together where the pillars had formerly stood, and rapidly ascending.

When I first looked, some of them had already reached a height of nearly 4' (100,000 miles), and while I watched them they rose, with a motion almost perceptible to the eye, until in ten minutes (1:05) the uppermost were more than 200,000 miles above the solar surface. This was ascertained by careful measurement; the mean of three closely accordant determinations gave 7' 49" as the extreme altitude attained, and

FIG. 2.



As the filaments rose they gradually faded away like a dissolving cloud,

*This is the name given by Schellen to the combination of astronomical telescope and spectroscope.

†The chromosphere (called also *sterra* by Proctor and others) is the layer of hydrogen and other gases which surrounds the sun to a depth of about 7,000 miles. Of this the prominences are mere extensions.

‡The sketches do not pretend to accuracy of detail, except the *th*; the three rolls in that are nearly exact.

and at 1:15 only a few filmy wisps, with some brighter low streamers down near the chromosphere, remained to mark the place.

But in the meanwhile the little thunder head, before alluded to, had grown and developed wonderfully into a mass of rolling and ever changing flame, to speak according to appearances. First it was crowded down, as it were, along the solar surface; later it rose, almost pyramidally, 50,000 miles in height; then its summit was drawn out into long filaments and threads, which were most curiously rolled backwards and downwards, like the volutes of an Ionic capital; and finally it faded away, and by 2:30 had vanished like the other. Figs. 3 and 4 show it in its full development; the former having been sketched at 1:40, and the latter at 1:55.

FIG. 3.



The whole phenomenon suggested most forcibly the idea of an explosion under the great prominence, acting mainly upwards, but also in all directions outwards, and then after an interval followed by a corresponding in-rush; and it seems far from impossible that

FIG. 4.



the mysterious coronal streamers, if they turn out to be truly solar, as now seems likely, may find their origin and explanation in such events.

The same afternoon, a portion of the chromosphere on the opposite (western) limb of the sun was, for several hours, in a state of unusual brilliance and excitement, and showed in the spectrum more than 120 bright lines, whose position was determined and catalogued—all that I had ever seen before, and some 15 or 20 besides.

Whether the fine *aurora borealis* which succeeded in the evening was really the earth's response to this magnificent outburst of the sun, is perhaps uncertain, but the coincidence is at least suggestive, and may easily become something more, if, as I somewhat confidently expect to learn, the Greenwich magnetic record indicates a disturbance precisely simultaneous with the solar explosion.

Are Men to Fly?

Darwin tells us that even in the upper regions of the air, near the summits of the Andes, vultures may be seen floating on miles upon motionless wings. What is the secret of this flotation? Gravitation acts as forcibly on the substance of the bird as on that of the animal. Nor can we believe that there is any buoyancy, properly so called, in the bird's body or wings.

Those vultures, which seemed to float steadily through still air, must have received support from the air in one or more of three several ways. Either by swift motion, acquired before the floating began and slowly reduced through the effects of aerial resistance, or by the action of aerial currents through which they were carried, or else, while seeming to float horizontally, they were in reality traversing a slightly sloped descending path. Neither of the two former explanations seems available, because the floating motion is continued so long that the frictional resistance of the air would almost certainly have destroyed a large share of the original motion through the air. This would equally happen whether the bird had in the first place urged its way swiftly through the air, or had floated itself off, so to speak, upon a swiftly moving air current. On the other hand, there would seem to be no valid objection against the third explanation; for a single observer, at rest, would have no means of determining whether a bird were sailing along horizontally, or gliding down a gentle incline. But it matters little which explanation of the three we accept as the most plausible. The point to be chiefly noticed is the fact that, a heavy body—for the vulture is no chicken, so to speak—can be sustained, for long distances, merely by the supporting action of the air.

There can be little doubt that it is only on account of the perfect steadiness of their motion through the air that they are thus supported. The efforts of aeronautical mechanicians must be directed to secure a similar steadiness of motion for aerial facilities. Granted this, there can be no reason why the powers of steam and iron should not avail to secure an aerial motion even surpassing in rapidity the flight of the swiftest birds. Unless we are willing to believe that birds fly by some power distinct from any which physical science deals with, we seem justified in believing that the bird may be matched, or surpassed, by the flying machine, as surely as the swiftest animals are surpassed by the locomotive. It is encouraging to consider that the actual amount of power necessary to convey a weight through the air (if that support is derived directly from the air), is very much less than that required to convey the same weight by sea or land. In the presence of failing coal supplies, this consideration will one day assume first-rate importance.—*Spectator*.

Baron Ferdinand de Lesseps, to whose perseverance and talent the world is indebted for the Suez Canal, has recently presented to Lafayette College, Pennsylvania, a set of twenty-three volumes of reports and documents relating to the conception and execution of the remarkable enterprise. The history of the work is complete to the smallest details, and is illustrated by beautifully executed maps and plans. This courteous attention will be appreciated by all our readers.

Correspondence.

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

Psychic Force.

To the Editor of the Scientific American:

Further information on this subject, published in your journal of last week, induces me to ask you for space to say a few words in reply to Dr. Vander Weyde's last letter.

His charges of "misstatements" are easily disposed of. He says "I did not plead ignorance of these experiments." His own words were: "How can B. D. expect that I would be able to unearth tricks which not only I had no opportunities to investigate, but which I have not even seen?" Now, as the learned Doctor gave the weight of his undoubtedly high authority to the statement that the effects in question were produced by jugglery, I cannot but think that his admission that he had not investigated or seen them is a confession of ignorance of them. I am more convinced that this view is a just one, for, in his next paragraph, the Doctor courageously makes the statement that these experiments are Home's, and that Dr. Crookes was merely a spectator. Now we have Dr. Crookes' authority for the fact that he devised the apparatus expressly to test the powers of Home, and, if possible, to "unearth" his "jugglery." He takes the entire responsibility of all the experiments, and has produced similar results with other persons than Home, some of whom were members of private families, and neither spiritualists, jugglers, learned Doctors, nor B. Ds. I think, therefore, we must hold the opinion that these experiments were Dr. Crookes'. Dr. Vander Weyde will, perhaps, continue to believe in the jugglery explanation.

The "tricks" which Dr. Vander Weyde calls "childish" were the exhibition of force upon a spring balance without contact except through water, and without contact at all. A similar result upon a parchment disk was produced by the presence of a lady who had no previous knowledge of the experiments or the apparatus.

In explanation, I informed Dr. Vander Weyde who Professor Crookes was. I now much regret to find that he was well aware of Dr. Crookes' labors and record, and that it was in the full possession of this knowledge that he accused him of going to work to find a result to fit a preconceived opinion. This last is the most serious charge that can be brought against a scientific investigator; but Dr. Vander Weyde has made it, and adheres to it. Perhaps this reckless accusation against Dr. Crookes would not have been made had Dr. Vander Weyde read the account of the further experiments; and this brings us back to our starting point, my original proposition that Dr. Vander Weyde's jugglery theory is incompatible with all we know of Dr. Crookes, will not bear the slightest comparison with the facts of the case, and was merely an assumption, unsatisfactory and unconvincing to any one in search of definite truth on the matter, and of which, perhaps, I was wrong to take any notice at all.

Dr. Vander Weyde speaks of the numerous spiritualists in the United States, a fact which has no relevancy to the subject. Certainly I have no desire to believe in what I like best, and am indifferent to the cause of Dr. Crookes' results; but these results were certainly achieved in direct contradiction to many popular opinions as to the nature of force, and are thus worthy of investigation. Dr. Vander Weyde promises in a future article to address himself to the subject, and calls my stating the question "an argument in favor of the deceiver Home." This is good, but better remains behind. He says that the psychic force theory arises from "the ancient misconception that force is separate from matter." We know that all force exists, primarily, in connection with matter. The psychic force theory is, as far as I understand it, that matter (the human body influenced by the human will, for instance) may move objects at a distance and without any material connection with such objects. If this theory be at variance with the positive physical sciences, the force of magnetism, which will operate through a vacuum, is also in contradiction to them; and must, I suppose, be explained on the jugglery hypothesis. Another "misconception" is that force can have its origin purely in the will or the mind. Dr. Vander Weyde cannot raise his hand to his head without endorsing this "misconception."

I certainly am not "prejudiced by a foregone conclusion." I do not as yet believe in the existence of a psychic force; I only say that it is a proper subject for philosophical enquiry, and that such is the only spirit in which to treat it. I do not know, nor, with due submission, does any one else, that there is no force yet undiscovered, and no unexplored field of investigation; but I do know that Dr. Crookes is an honest and acute observer, and that the jugglery theory will not bear inspection. Your readers will, I believe, think that Dr. Crookes' strictly scientific investigation of the phenomena in question does him infinite credit; and that is by experiment and proof only that he will stand or fall. With the expression of these views I began, and so will I end, with many thanks for the use of your valued columns.

Jersey City.

B. D.

Comparative Efficiency of different kinds of Boiler Plates for Steam Generation.

To the Editor of the Scientific American:

None of the various causes which engineers have assigned for the wide differences in the evaporative powers of boilers have seemed to be sufficient and conclusive; and some other important element of variation has long been suspected by those who have given thought to the matter.

In order to discover this hitherto unknown cause, a series of experiments was made, based on the supposition that the conditions which affect the conducting power of a metal for

electricity—alloys and impurities—would, perhaps in equal degrees, affect its power for transmission of heat.

It was evident that all previous estimates of comparative values of fuels, modes of firing, and styles of boilers (the universally recognized causes of variation), would be subject to careful revision if it could be demonstrated that the most important source of error had hitherto been overlooked. The accepted standard results would become valueless.

Nine pieces of boiler plates of different brands were selected for the purpose of the experiment; they were of uniform thickness ($\frac{5}{16}$ of an inch.) Some of them were samples of locomotive fire box plate, and the others of boiler plate.

They were tested for their heat transmitting and steam generating efficiency, with the following results: Allowing the plate of lowest transmitting power to have a value of 100, we have

1	Power of transmission	100
2	" " "	104.4
3	" " "	117.7
4	" " "	118.8
5	" " "	121
6	" " "	123
7	" " "	123.3
8	" " "	141.9
9	" " "	144

It must be distinctly understood that these transmitting powers were measured by the generation of steam under equal and similar conditions. Each plate was subjected to a number of trials; the temperature of the flame to which it was exposed varying, during each series of trials, but a very few degrees from 550° Fahr., and the time of evaporation of the water but a few seconds.

The ratios of values have been calculated according to the tables for such purposes prepared by Dulong. The experiments have been conducted by Mr. Charles E. Avery, of Boston, a gentleman thoroughly competent by scientific and practical knowledge for the undertaking of such delicate work.

In order to discover and avoid all sources of error, the apparatus and method finally adopted for these determinations were first subjected to the test of weeks of most careful experiment.

To generate an equal amount of steam in equal times and with similar conditions of fuel and draft, boilers made of Nos. 8 and 9 plates would consume constantly 40 per cent. less fuel than boilers made of plates Nos. 1 and 2.

Inasmuch, therefore, as their efficiency in the production of steam is vastly greater than that of the inferior plates, the commercial values of these plates will be still greater in proportion. The possibility of a daily economy of 40 per cent of fuel should induce boiler users to purchase the best plate and boiler plate manufacturers to exercise more care in its manufacture.

Some of the most considerable variations in evaporative efficiency were found between plates from the same manufactory.

No analyses of the iron of the plates have been made, it having been assumed that the comparative presence or absence of slag or glass—a poor conductor of heat—was the chief cause of the determined variations; though, doubtless, carbon and other elements will be found to exercise decided influences. These we propose to determine; and other points of novelty and interest in regard to boiler plates have been decided, which we hope at some future day to give to the public.

With our method of firing (our application of pulverized fuel to the generation of steam), which almost entirely eliminates other causes of variation, we had found one boiler to have an evaporative efficiency of nearly 60 per cent. more than another. Hence the search for the unknown causes of variation.

JACOB J. STORER.

BOSTON, Nov. 1, 1871.

JAMES D. WHELFLEY.

Perpetual Motion—Experience of a Man who took an Interest in one.

To the Editor of the Scientific American:

There has always been a perpetual movement in the direction of perpetual motion, but the problem still awaits an answer. The nearest approach to the desired result was attained by the "Wandering Jew," who started his movements several centuries ago, and was still on the move at last accounts.

I had a dear friend (I say dear because he cost me considerable), who experimented to some extent in perpetual motion on borrowed capital. I took some interest (16 per cent) in his investigations, and was present at most of his failures. He performed in a small room, six stories from the ground, where he might have been seen at almost any time, surrounded by wheels, springs, levers, pulleys, and screws, in fact by almost everything into which brass and iron might be made. I never knew a man more confident of success; he would ask for money without regard to my interest, being sure he could pay five dollars for one. He went around pricing the finest residences in the city, examining thousand dollar houses, talked about making a gold model of his machine, buying a steamboat, and making other modest purchases.

In a conversation with him, while at his work, I asked: "Why do you have so much machinery and complication in your experiments? You only confuse your mind with the combinations, and can't tell what the result will be when the machine is finished." He answered me: "Who was making that machine?" I didn't reply, but couldn't help thinking whose money was in it.

At another time (when in a better humor) he asked what course I would advise in experimenting, if I didn't like his. In reply I said: "Get a stick four feet long, balance it on a fulcrum, place weight enough on one end to raise the other;

you have by this means accomplished one motion; then place weight enough on the other end to raise the first, and so on till you break the stick. In this way you can accomplish about all any one ever has." He seemed to think I didn't mean what I said, and so made no reply.

At another time he said: "Luke, you have taken considerable interest in this machine, and paid some attention to its construction. I want to ask what conclusion you have come to." I said, "I have come to the conclusion that all in this world is a perfect balance, except your mind." He got huffy at this, and didn't speak for twenty minutes.

At last the final day arrived; he got me to hold the machine while he put in the last screw, which was to complete the model, and start it on its never ending journey.

The screw was in—he was seated in a chair—I still had hold of the machine. He said: "Let go carefully, or it will tear things to pieces." I let go—the machine moved not. He assumed the consistency of a dish cloth, and hung over the back of the chair. He now resides in the insane asylum; his mind is gone, and so is my money. From that day to this I have had but little confidence in perpetual motion.

LUKE COPPERTON.

Ice Fleas.

To the Editor of the Scientific American:

On page 272, current volume of the SCIENTIFIC AMERICAN, you give an interesting article by E. Franklin, in *Nature*, and in it the question is asked: "Is the ice flea like its irritating cousin?"

Having a knowledge of the insect referred to, not, however by having found it on the Morteratsch Glacier, yet under identical circumstances, I will state that the insect in question belongs to an order of animals termed *Ametabolia* (without change), a sub-class of insects which do not undergo any metamorphosis. Among these are included the order *Thysanura* (Leach), and genera of *Lepisma*, *Forficina*, *Petrobius*, *Podura*. Of this latter there are a great number of species, as well as in the genus *Sminthurus*, which two were united by Fabricius as identical. In Rees' "Cyclopaedia" I find thirty species described, from Gmelin. I expected Dr. Harris would have met with this minute creature, which is often highly injurious in the vegetable garden, by the immense number that are met with. I will quote *verbatim* from Maunders' "Treasury of Natural History" (before I give my own experience), which reads thus: "*Podura*.—The *Podura* are small insects, which, in general, are found in damp places, under stones, on the bark of trees, etc. When disturbed, they suddenly spring to a small distance by the help of a long forked process or tail, which is bent forward beneath the abdomen; and it is by the sudden extension of it that the leap is produced. Hence these insects are commonly known under the name of "spring tails." One of the most common of this genus is the *Podura aquatica* of Linnaeus, a minute black insect, occasionally seen in vast numbers, particularly near the brinks of ponds, and sometimes even on the surface of the water itself."

This species is further described as measuring scarcely the one twelfth of an inch in length, and entirely of a black color. It is a gregarious species, collecting in numbers so great as to have the appearance of scattered grains of gunpowder; and if closely examined (when on the ground) will be found in almost perpetual skipping motion.

I have met with them during the winter, when there was snow on the ground, hibernating under stones, availing themselves of the "conduction, partly by radiation, from its under surface." They understand, instinctively, the action of the "luminous thermal rays." But then their leap differs from "the performance of a common flea," and is not so nearly related as that of "cousin." The common flea (*Pulex irritans*—Lin.) belongs to a different class, and is included among the *Aphaniptera* orders—name, Greek, "unseen" and "wing." The apterous *haustellate* insects have rudimentary wings in the perfect state. These undergo a metamorphosis in a marked degree.

I might have passed the article without notice, were it not that we have species of *Podura* that do a vast amount of mischief occasionally, and are almost unknown to modern entomologists.

JACOB STAUFFER.

Lancaster, Pa.

Safety Valve—A Leaf from a Practical Engineer's Experience.

To the Editor of the Scientific American:

In your issue of October 14th, John Maller says: "While I was running a portable engine, the steam rose from 80 to 140 lbs. in about four seconds. I raised the safety valve lever as high as the construction of the connection would allow, till mud and foam rose high in the air, and the pressure came down to the running point."

Now a boiler that will throw mud and foam out, through the safety valve, is in a very dirty condition, and not fit for service until it has been thoroughly washed out and cleaned. After publishing such carelessness to the world, he asks for the construction of a safety valve that will enable him, and others, to practice such carelessness with impunity.

He says: "We need a valve that will rise two or three inches out of its seat in one moment, so as to give full relief before the pressure has time to get to bursting point. It would almost entirely do away with the idea that, if part of the fire surface gets red hot, and the water rises over it in that condition, that there must be an explosion." Now as none of us care to arrive at the bursting point, I would ask, where is the necessity, or reason, for allowing steam to rise above its working pressure? Even if it did, the raising of the safety valve, several inches out of its seat, would not cause steam, or mud either, to flow more readily than when

raised a certain height, which height is determined by dividing the area of the opening by its circumference.

Again, it is not absolutely certain that an explosion will result from water being thrown on red hot fire surfaces; yet no engineer, who has any regard for his reputation, or for the property under his control, whatever might be the size and number of safety valves, would risk it, under any circumstances, well knowing that damage is as sure to result to the boiler as it is done. Red hot metal is weak, and an explosion or collapse does not necessarily result from the sudden accumulation of steam when water is thrown on it; but the metal, in this state, is not able to bear the ordinary working pressure. When boilers are properly constructed and properly managed, explosions will cease, but not before.

Macon, Miss.

L. E.

Fireproof Safes.

To the Editor of the Scientific American:

In your issue of October 28 is an article entitled "Fireproof Safes—Improvements urgently called for," and I would earnestly ask the privilege of making some reply to the same.

A word, first, in reference to the Chicago fire, in which the safes referred to failed to preserve their contents. Here was a vast city, with thousands of wooden buildings, shingled roofs, wooden stables filled with hay and straw, planing mills crowded with dry lumber, shavings, and kindling wood—cabinet shops, lumber yards, gas works, etc. etc. After a long drouth, with every thing as dry as tinder, a fire occurs in a hay stable, at a time when the wind is blowing a hurricane. In a very short time the fire is beyond all human control. Before its terrible march, iron walls melt as before the blast of a furnace, and soon a very large portion of the great city is in ruins. In view of the circumstances, the wonder is not that the city was burned at last; but that it has stood so long unconsumed.

Now comes the reproach to the builders of the so called fireproof buildings, and also, of course, to the makers of fireproof safes. Perhaps the reproach in both cases is well deserved; but I think not. The builder of a fireproof store never contemplated placing his work before the terrific power of a blast furnace; yet, from the testimony of eye-witnesses, the hurricane was the same in effect as the "blast" of a smelting furnace, and the iron, of course, was melted. What, then, is the use of a fireproof building? We answer: Had the city been properly built, with no wooden structures, and no shingled roofs, but with substantial stone, brick, iron, and slate, the fire could not have spread—even under the power of a hurricane—beyond the control of a well organized fire department, and the intense heat, which melted the iron of the fireproof buildings, could not have existed. The builders of fireproof structures cannot justly be held accountable for results arising from such circumstances.

Now, as to the fireproof safes which failed: What is the construction of a fireproof safe? Simply this: An iron box is made, an iron lining is placed inside, leaving a few inches space between it and the outside wall of the iron box. This space is filled with some material which contains moisture; and, when the safe is exposed to a fire, the moisture is evaporated into the interior of the safe; and while the moisture lasts, the heat cannot consume the books, papers, etc., placed in the center of the safe. Various materials are and have been used. Substances which contain a large percentage of what is called the water of crystallization, as plaster and alum, and various kinds of concrete, are also employed with more or less success. And safes thus supplied, when exposed for the same length of time to an equal degree of heat, will preserve their contents just as long in proportion as the relative degree of moisture exists in their filling, and no longer. One kind of safe has the space between the walls filled entirely with water; and this kind, it would seem, when equally exposed, would preserve its contents much longer than safes, a portion only of whose filling is water. One of these water filled safes, on the published testimony of the proprietor of a hotel which was burned a few weeks since at Ithaca, N. Y., was exposed to the hottest of the fire for a period of sixty hours, and yet kept its contents uninjured. Now, the Chicago fire lasted from ten to twenty days. I mean by this, that the vast mass of *débris* which fell was, at the time of falling, not one half, and probably not one quarter part, consumed to ashes; and after the fire, driven by the tornado, had passed on, this vast mass of timbers and other inflammable materials continued to burn for many days unquenched; and the moisture contained in safes of any kind must, of course, have been exhausted long before the flames and live coals, which surrounded and embedded the safes, were either burned out or quenched. Of course the contents of safes thus exposed were consumed.

Who ever constructed a safe of any kind with the expectation of such an ordeal? It were just as reasonable to reproach the insurance companies with their failure. Who ever expected insurance companies to meet liabilities amounting to two or three hundred millions of dollars? No one. The wonder is that the insurance companies have stood the disaster as well as they have.

The merchants, and people generally who buy safes, usually try to get them as cheaply as possible. But there is no such thing as a cheap safe. If you want protection from fire and thieves, be willing to pay for it.

In most counting rooms and offices, there is plenty of room for the black walnut desks, tables, and other elegant furniture. But the safe, though gilded and landscaped, is begrudged the little room it occupies, and so the manufacturer must make it of the smallest possible dimensions; conse-

quently he cannot put in filling enough of any kind—even clear water—to outlast a very long conflagration. The fact is, that safety is obtained by quantity. The water safe at Ithaca went through a test of sixty hours. Can any sane man doubt that, had it contained four times as much water as it did, it would outlast a fire of more than four times sixty hours? A safe will preserve its contents till all its moisture is used up, and no longer. But when any kind of safe of the usual size—let its filling be what it may—is kept in a furnace for ten, twelve, fifteen, or twenty days, is it a matter of surprise or reproach that its moisture is exhausted, and its contents consumed? If you mean to have such fires as that of Chicago, then give the safe makers leave to build their safes large in proportion.

How can any real improvement be made? There is nothing but moisture,—that is, water held in some form—that can be used. If the safe was made of a material absolutely nonconsumable, it would not avail, for the heat would consume its contents. Carbonic acid gas, it is said, will quench flame quicker than water. But there is no flame to be quenched inside a safe during a conflagration. When the books and papers are hot enough to burst into a flame, they may as well burn, for they are already destroyed.

The only improvement of consequence, of which we can conceive, is in the increase of the amount of the filling which gives out the moisture, and the building of towns and cities of material that cannot kindle, even under the force of a hurricane, so rapidly that a well organized fire department cannot control it.

JUSTICE.

Protection against Fire.

To the Editor of the Scientific American:

It seems to me that the SCIENTIFIC AMERICAN is the proper vehicle to convey useful knowledge from one portion of the people to another.

The recent fires are sufficient to awaken the spirit of reform in building. But we must bear in mind that we have, in our midst, very many enterprising young men who, if they build at all, and have any thing left to commence business with, must study economy. But, if we would combine economy with utility and safety, we must make great reform in the mode and construction of building.

Now, if we will dispense with wooden walls and roofs altogether, we shall save nearly enough to erect our buildings with mineral substances, provided we use economy in the use of the latter.

For example, take the roof. Slate, in St. Albans, can be put on for \$8 per square, a trifle dearer than shingles; while, in Rutland, slate is \$1 per square cheaper than shingles.

Next, for the outside walls. If we were to lay up two courses of brick—laying them two inches apart (of course, binding them with "headers")—we should get a "dead" space between the two courses, which would render the building dry and warm; and, at the same time, enable us to plaster upon the bricks without any laths, thus saving the frame, boarding, clapboarding, lathing and back plastering. And not only this, but we could use poor bricks for the inside course. We could also introduce a new article of ornamental bricks for the formation of cornices and brackets. In this way, we can, if we will, make a reform in building materials, increasing the expense of building but very little.

Inside walls may also be formed of one course of poor bricks. If made of wood at all, they should be formed of planks, and set as tightly together as possible. The spaces between floor joists, or at least that portion next to partitions and walls, should be packed with mortar, broken bricks, cobble stones, etc. The worst feature in our present mode of constructing wooden buildings is the open space between the floor joists and the studding. In case of fire, these spaces form so many flues to lead the devouring element in every direction at once, so that a single spark of fire in some remote corner is sufficient, with the aid of these flues, to wrap the entire structure in one sheet of flame in a very few minutes.

Remember, I am not now advocating fireproof buildings, but simply cheap buildings, and the very cheapest that should ever be allowed to go up in a densely populated place.

Under the present state of affairs, there is seldom any hope of saving the building in which a fire originates; and, if a conflagration can be stopped by pulling down two or three buildings, we think ourselves lucky; whereas, if we had commenced twenty years ago to build with proper materials, and, at the same time, built so compactly as to leave no spaces in the walls and flooring for fire to run in, but few buildings, comparatively, would be burned; for the fire would make so much less rapid progress that it would, in nine cases out of ten, be put out where it originated. So that, in the end, we should save, in insurance and in the fire department alone, more than the extra expense accruing from a more substantial mode of building, to say nothing of the enormous losses and suffering by fire.

CHARLES THOMPSON.

St. Albans, Vt.

A Blacksmith's Piano-forte.

To the Editor of the Scientific American:

Having seen several notices, in your columns, of the early manufacture of pianos in the United States, I propose to place on record the performances of a South Carolina mechanic.

About the year 1823, the first piano was introduced into this portion of what was then Pendleton district. Being quite a curiosity, it was "interviewed" by many of the neighbors, among others by William Turner, a young blacksmith, who examined its construction. In a short time, he exhibited a piano of his own manufacture, the wire forged under the hammer and drawn by hand, and the keys made

of bone and wood. This instrument was for many years in the possession of Daniel E. Riley, late of Pickens county, and, for aught I know, may be still in existence. I have frequently amused myself, when a boy, trying to play on it.

Encouraged by the success of this experiment, Turner made a trip to Augusta, bought wire and ivory, and made—for the time—a pretty respectable instrument, which he sold to a gentleman, whose name I have forgotten, whose family used it for many years.

I had in my possession, for several years, a penknife of exquisite temper and polish, one inch and a quarter long when open, which Turner made about the same time and presented to my mother.

Turner emigrated to Illinois in my boyhood, took up the trade of millwright, and, I believe, was killed by a fall about thirty five years since.

Anderson Co., S. C.

E.

Incident in Engineering.

To the Editor of the Scientific American:

Permit me, as a practical engineer, to mention a circumstance that occurred to me while in charge of a stationary steam engine. My engine was stopped with but little fire under the boilers. I tried the water, and found two solid gages, and noticed by my steam gage that I had forty pounds of steam. I went up stairs and returned in about a half hour, tried my water again, and found the gages remained in, neither water or steam coming out. I looked in the furnace, and saw that the sheet directly over the fire was red hot. It was a mystery to me what had become of the water and steam which was there but a few minutes before.

After the boiler had cooled, I let in water, and found it ran out at the bottom of the boiler, as fast as I let it in. I found, on inspection, that the bottom sheet, about five sheets from the front end, had opened for a space of twelve inches, in direction of its length, and quietly allowed the water and steam to blow out without doing any damage. Now why did it not produce as disastrous an explosion as the Westfield boiler, which had only twenty-seven pounds, as it is said? Because the plates of the boiler were not overheated, and there was no sudden formation of steam of immense pressure, as there might have been, had I had a hot fire with the engine standing still. I give this for what it is worth. I would like to see it commented on in your paper. Being a young engineer, I am desirous of learning.

St. Louis, Mo.

F. WEST.

Plumb Line Variation.

To the Editor of the Scientific American:

The deviation of the plumb line from the vertical, at the shaft of the Hoosac Tunnel, has called forth the mathematical acumen of the writers in the SCIENTIFIC AMERICAN, of January 14th and October 14th, 1871.

Their learned expositions, which are accusively conflicting with each other, "both in principle and result," may be simplified by the following version. The rotary velocity of the earth at the surface decreases as the depth, and the plumb line, when descending, will incline eastward from the vertical, but when arrested in its descent, will, as a pendulum, vibrate past a true vertical line of direction, until brought to rest, when the plumb line itself will be vertical.

The above relative action and positions would take place at any depth, or with any difference of rotary velocities, and consequently, no practical difficulty can be experienced, which important item the said writers have omitted to state.

The central direction of gravity constantly tends to draw the plumb from its deviation, and, if lowered very slowly, no appreciable divergent angle would be formed, being nearly equivalent to a stationary condition of the plumb.

Pittsburgh, Pa.

THOS. W. BAKEWELL.

Cundurango.

The Secretary of State, Hon. Hamilton Fish, has transmitted to the Department of Agriculture a package containing specimens of the fruit and seed bearing capsules of the "cundurango" plant or vine, received from Charles Weile, United States Consul at Guayaquil, together with the following extract from the official letter of the consul:

"I have just returned from a visit to the cundurango region, in the province of Loja, where I spent a month in collecting the different species of the plant. Dr. Destruge, of this city, an excellent botanist, has classified the vine as belonging to the order *asclepiadiæ*. The word 'cundurango' is a compound of 'cundur,' eagle, and 'ango,' a vine. The aborigines probably applied this name owing to the winding growth of the vine, and because it seeks the highest trees for its support. Its growth is most vigorous in moist places, on the banks of rivers and creeks, where the body often attains a diameter of two or three inches, diminishing gradually to tendrils at the top. The family is a numerous one. Leaves, vines, fruit and flowers of the species differ materially, but all contain—some in a greater degree than others—a liquid that resembles milk, and which, exposed to heat or coming in contact with other bodies, coagulates and forms an aromatic resinous substance."

Inclosed was a list of the specimens and a piece of the balsam which the milk produces. The list names the following varieties, all found at Zaruma: No. 1. *Cundurango Pepino*; No. 2. *C. Tumbo Grande*; No. 3. *C. Tumbo Chico*; No. 4. Variety of *C. Tumbo Grande*; No. 5. *C. Paloma Grande*; No. 6. *C. Batea Grande*.

The seeds received by the Agricultural Department will be propagated, with the design of testing the practicability of the cultivation of the plant in some section of this country, should its production be found to be desirable.

Locomotive Alarm Bell.

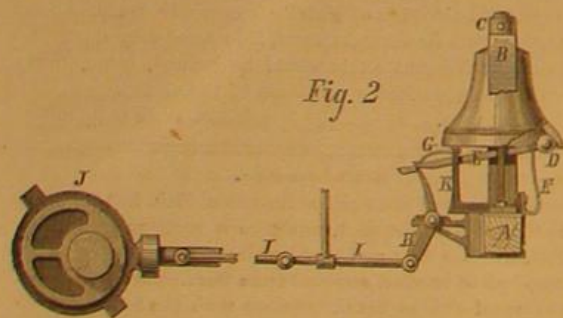
The accompanying engraving represents a continuous ringing or sounding alarm bell, placed on the front beam of a locomotive engine, for the purpose of warning persons about to cross the railroad, or who may be in its vicinity. The bell, it will be seen by the engraving, is so attached that when the engine goes, the bell rings, being struck by the hammer once at each revolution of the driving wheels. Being placed directly in front of the boiler, the ringing or sound of the bell is seldom heard by the engineer or fireman on the engine, and cannot be heard on the train; consequently it is no annoyance to passengers, while, it is claimed, its position causes the sound to be thrown forward, and conducted, by the earth and the railroad track or rails, so that it can be heard a considerable distance in advance of the train, thus giving timely warning.

The inventor, Mr. B. Briscoe, Mechanical Superintendent of the Detroit and Milwaukee Railroad and Steamship line, writes us that these bells have been placed on the engines of that road, 34 in all, and he has no doubt but that it has prevented many accidents, and perhaps saved many lives. He says that during the two years the alarm has been used, "we have not struck a team or vehicle of any kind at or near a crossing, while such accidents (though not frequent) did occur, and, in some cases, loss of life and valuable property resulted before the alarm was brought into use."

The General Superintendent of the road also speaks in high terms of the value of the invention, and states that they are now on trial by some other roads. He thinks the recent terrible accident on the Eastern road would have been certainly prevented by its use.

Upon examination of the invention, we concur in these opinions, and have no doubt that both railway companies and the public would be benefitted by its general introduction, in the diminution of the number of accidents, and in the simplification of litigations arising therefrom. It is often the case in suits arising from railway accidents that there is a disagreement on the part of witnesses as to whether the bell was ringing at the time or not. The application of this improvement would settle all doubts arising from such conflict of testimony, and thus benefit companies, while the certainty of the alarm would prevent accidents arising from neglect.

Fig. 1 is a perspective view of a locomotive with the alarm attached. Fig. 2 is a diagram showing the details of construction.



A represents the front beam of the locomotive, upon which is properly secured the yoke, B, to which the bell is suspended in the following manner: The shank of the bell is turned off smoothly, and inserted through a hole through the top of the frame, which hole is bored to fit the shank of the bell closely, and, at the same time, not so tightly as to prevent the bell from being rotated.

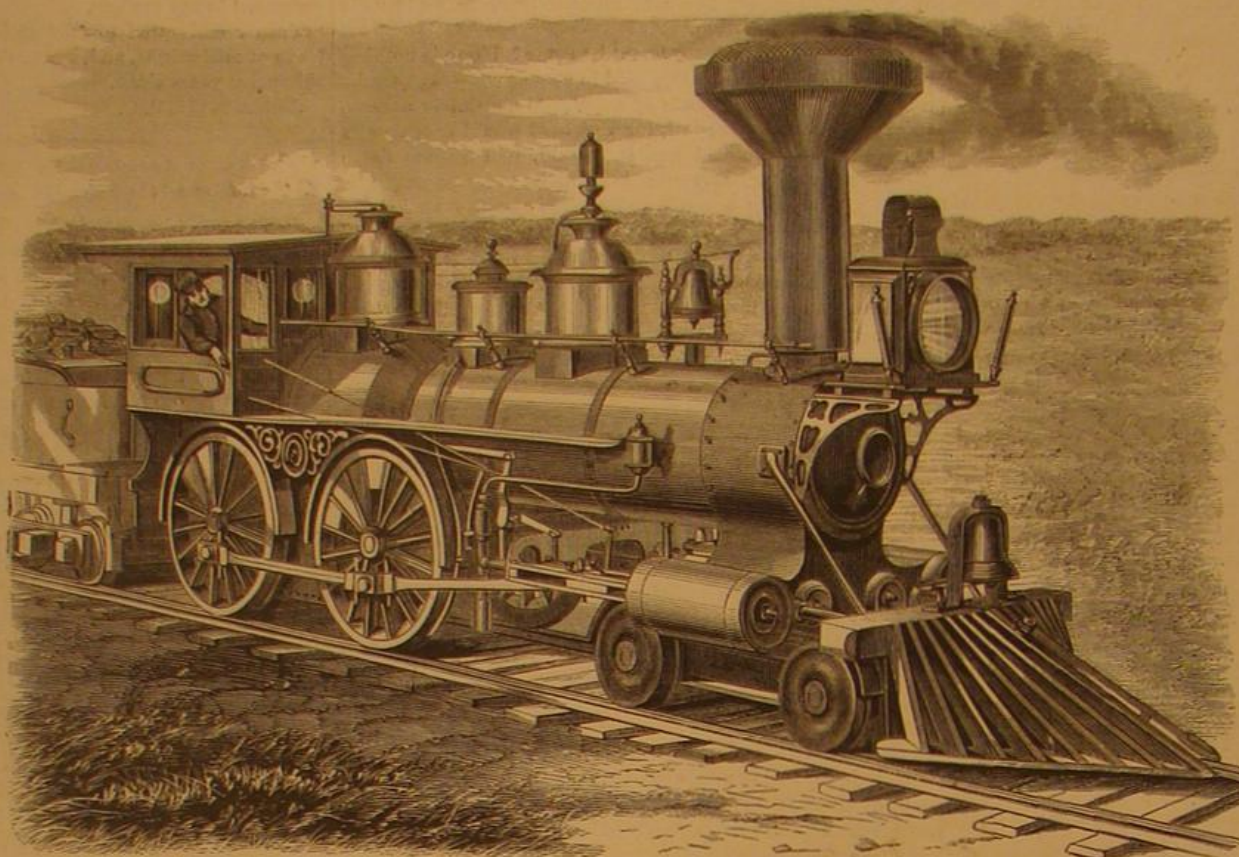
The top of the shank is provided with a proper nut, C, by means of which it is held in the yoke, and which rests upon a metal washer, which, in turn, rests upon a rubber washer, placed on the top of the frame and surrounding the shank. By this means the bell is secured in a vertical position, allowing it no motion but a rotary one about its vertical axis. A hammer, D, is attached to the lever, E. This lever is sustained by the two vertical guides, K, and is actuated by a spiral spring, F. The lever is also held in position by the spring, G, which prevents it from being thrown out of place by the lever, H, which is pivoted to a bracket, and has its lower end pivoted to the connecting rod, I, which receives reciprocating motion from the revolution of the eccentric, J.

The hammer may be so placed as to impinge against the outer or inner side of the bell, as desired. In either case it is secured, in a position out of the line of the center of the bell, in such a manner that each stroke of the hammer will rotate the bell a little distance.

The locomotive being in operation, the revolutions of the

eccentric communicate a rocking motion to the lever, H, by means of the connecting rod. The upper end of this lever engages with a notch on the lower side of the lever, E, there, by withdrawing the hammer head from the side of the bell, and compressing the spring, F. The lever, E, being thus withdrawn, is slightly elevated, in the shorter guide, by the lever, H, and the latter is disengaged from the notch in the lever, E, which is instantly forced down by the spring, G, when the recoil of the spring, F, throws the hammer violently forward against the bell.

A constant and positive action is thus secured; the appara-



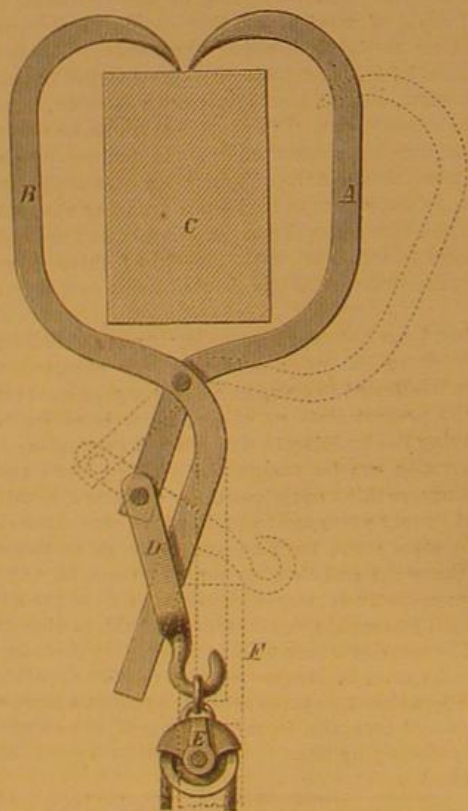
BRISCOE'S LOCOMOTIVE ALARM BELL.

tus, interfering in no way with other working parts of the locomotive, is so placed as to be out of the way, while its position is favorable to throw the sound in advance of the train.

Patented March 2, 1869. For further information address Benjamin Briscoe, care Detroit and Milwaukee Railroad Company, Detroit, Mich.

BEBOUT'S RAFTER HOOK.

This invention is intended to supply a simple, easily attached, and readily detachable rafter hook, for the support of the tackle of horse hay forks, steelyards, and, in general, for any purpose to which such a device can be conveniently



applied. Farmers and owners of warehouses will at once see the convenience of the improvement, upon perusal of the accompanying description.

Referring to the engraving, A represents a jointed hook bar, and B a similar bar, not jointed; C is the section of a rafter, joist or beam, to which the apparatus is attached, and D is a short bar, pivoted or jointed to the hook, which, together with the hook bar, constitutes the jointed hook bar lettered A. E is a sheave over which the rope is passed for the suspension or elevation of the object to be supported or raised. F is a pole shown in dotted outline. Into a socket in the end of this pole, the shank or lower end of the hook bar, B, enters, when it is desired to put up or take down the apparatus.

Pushing up on this pole disengages both the hook bars from the timber, and they then assume the position shown in the dotted outline. Reversing the operation attaches the apparatus, when the pole may be taken away until it is required to move the hook to some other part of the building.

This invention was patented through the Scientific American Patent Agency, August 8th, 1871, by John Newton Bebout of Oberlin, Ohio, who may be addressed for further information.

Students do not Sleep Enough.

It has become common for the students in our principal colleges to publish weekly, monthly, or quarterly journals, the matter being supplied principally by the students themselves, and relating to college affairs. Some of these are very creditable in character. Among the most respectable is *The Williams Vidette*, from which we copy the following caution:

"Students, as a class, do not sleep enough. There is no law so fundamental and imperative on the student, as the law which requires him to sleep, and no other law does he so systematically and recklessly ignore.

"It is a popularly accepted fallacy that students and literary men do not require as much sleep as mechanics and laborers. Physiology shows us that, during the operation of the intellect, rapid changes of tissue take place, and that a few hours of close application to thought and study exhaust the system more than two or three times the same period devoted to manual labor. It is evident, then, in

order to compensate for this greater waste of tissue, that the brain worker will require more sleep than the muscle worker.

"In the violation of this first great hygienic commandment is found the secret of most of the special diseases to which the student is liable. To this cause can be traced the eye affections that are so common. By neglecting to obtain sufficient rest, the system becomes relaxed and its tone lowered, thereby inviting disease, of which these organs, being especially overtaxed and weakened, are the first to become sensible.

"Anything, therefore, which is intended to increase our facilities for sleeping, is of the highest importance and interest."

What Railway Dust is Composed of.

Mr. Joseph Sidebotham has made a microscopical examination of dust blown into a railway carriage near Birmingham. He says: "I spread a paper on the seat of the carriage, near the open window, and collected the dust that fell upon it. A rough examination of this, with a two thirds power, showed a large portion of fragments of iron, and, on applying a soft iron needle, I found that many of them were highly magnetic. They were mostly long, thin, and straight, the largest being about 1-150th of an inch, and, under the power used, had the appearance of a quantity of old nails. I then, with a magnet, separated the iron from the other particles.

"The weight, altogether, of the dust collected was 5.7 grains, and the proportion of those particles composed wholly, or in part, of iron was 2.9 grains, or more than one half. The iron thus separated consisted chiefly of fused particles of dross or burned iron, like 'clinkers'; many were more or less spherical, like those, brought to our notice by Mr. Dancer, from the flue of a furnace, but none so smooth; they were all more or less covered with spikes and excrescences, some having long tails, like the old 'Prince Rupert's drops'; there were also many small, angular particles like cast iron, having crystalline structure.

"The other portion of the dust consisted largely of cinders, some very bright angular fragments of glass or quartz, a few bits of yellow metal, opaque, white, and spherical bodies, grains of sand, a few bits of coal, etc.

"After the examination of this dust, I could easily understand why it had produced such irritation; the number of angular, pointed, and spiked pieces of iron, and the scoria, or clinkers, being quite sufficient to account for the unpleasant effect.

"I think it probable that the magnetic strips of iron are laminæ from the rails and tires of the wheels, and the other iron particles, portions of fused metal, either from the coal or from the furnace bars. The large proportion of iron found in the dust is probably owing to the metal being heavier than the ordinary dust, and accumulating in cuttings such as those between the two stations named.

"If I had to travel much by railway through that district, I should like to wear magnetic railway spectacles, and a magnetic respirator in dry weather."

TEMPTATIONS are enemies, outside the castle, seeking entrance.

Scientific American.

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EVAPORATIVE POWER OF BOILERS.

Engineers, accustomed to test the evaporative power of boilers, are aware of certain apparent variations, in steam generating capacity, unaccounted for by differences in construction. Two boilers exactly alike, or enough so to be called alike, will, under the same apparent circumstances, perform unequally.

This is not the only instance in mechanics where such unaccountable differences have been observed. Musicians have observed that, of two violins as nearly alike as human skill can make them, one may be a valuable and the other a comparatively worthless instrument. Those who have studied the art of violin making attribute the difference in tone to unexplained peculiarities in the wood from which these instruments are made.

Similarly Messrs. James D. Whelpley and Jacob I. Storer, whose communication upon this subject will be found in another column, attribute marked differences in the action of boilers to differences in the iron of which they are made, and the tabulated results of their experiments certainly seem to justify their opinion.

These gentlemen have long been known to the engineering public through their attempts to bring about more economical combustion of fuel and more efficient application of heat, to the production of steam, the operations of smelting, puddling, etc.; and their experiments will call attention to a point in boiler construction hitherto, in a great degree, overlooked.

But while we are willing to concede that the quality of boiler iron may greatly affect its power to transmit heat, we think the difference in quality which produces such a result will be found to be mechanical rather than chemical, as Messrs. Whelpley and Storer would seem to think in their remark on the effect of alloys and impurities. At least we have no doubt that molecular conditions, not dependent upon chemical affinity, do affect the conducting power of metals both for electricity and heat.

It is certain that in many substances molecular structure has much to do with conducting power. Wood conducts heat with far greater facility in the direction of the grain than across it. Crystals are well known to exhibit similar variations, in conducting power, relative to the direction of their axes. Conduction is also known to be affected by the conditions of homogeneity or non-homogeneity.

Now as iron is more or less crystalline in structure, according to the thoroughness with which it has been worked, and the presence or absence of foreign materials, we are of the opinion that some of the variations observed by Messrs. Whelpley and Storer may be referred to the arrangement of these imperfect crystals or fibers in the plate, and perhaps to certain approaches to lamellated structure, consequent upon defects in manufacture.

Whatever their cause, if the differences be thoroughly established, they are of the utmost practical importance, and we trust the investigation thus begun will lead to such a general examination and discussion as will throw more light upon the important subject of economical steam production.

THE OPEN POLAR SEA.

In our journal of November 4th, we announced the welcome news that a region, free from ice, of comparatively moderate temperature, had been discovered in the centre of the Arctic Circle. This open space, only to be reached by traversing an almost impenetrable barrier of winter bound country, has long been supposed to exist. The flattening of the earth, at the north and south poles, diminishes the radius of our globe, and brings the surface nearer the internal heat

of the earth, by thirteen miles; and our readers will understand that the comparative proximity, of the open polar spaces, to the central fire, will make, unless diminished by other causes, an enormous increase in the surface temperature.

Putting the solar and atmospheric influences altogether out of the question, the heat of the earth increases, as we descend, at the considerable rate of about 37° Fahrenheit for every thousand feet; and the theory that the heightened temperature in the centre of the Arctic Circle is more than sufficient to overcome the cold induced by the feebleness and, at the actual poles, the absence, of the sun's direct rays, has always been regarded by physical geographers as eminently reasonable, and is now, by actual experiment, found to be true.

We need hardly recapitulate the various attempts that have been made to penetrate the ice barriers of the Arctic region, and the, in many instances, self sacrificing courage and bravery of the explorers. The names of Buchan, Franklin, Ross, Parry, Kane and others, are known, in connection with this subject, to all our readers; and the difficulties and privations they have endured, the wonderful scenes and countries they have visited, make a history, fuller of strange and romantic incident than the most improbable creations of fiction. Of the hardihood and endurance of the men who have devoted themselves to the investigation of this great subject, many instances might be cited; the following, however, gives a just idea of the nature of their task, and of the men who gave their labors, and in many instances their lives, to its accomplishment:

In September, 1819, an overland expedition left the western shore of Hudson's Bay. The party consisted of Lieutenant Sir John Franklin, Doctor Sir John Richardson, Midshipmen Hood and Back, and a seaman named Hepburn. It was calculated that this party would meet Sir John Parry, on his first exploring voyage, at some point on the coast. Sir John and his fellow travellers reached Chipewyan on March 26, 1820, having journeyed on foot nearly nine hundred miles, in a climate which froze the mercury in their thermometers. In July of the same year, they were at Fort Enterprise, five hundred miles further on, and arranged to winter there, dispatching Mr. Back to Fort Chipewyan, to forward supplies. Mr. Back reached Fort Enterprise again on March 17, 1821, having journeyed eleven hundred miles, the thermometer averaging about 50° below the zero of Fahrenheit. He had only a blanket and a deerskin for covering at night, and was frequently two or three days at a time without food. Three months afterwards, the party was at Coppermine, 80 miles further on, having dragged their canoes, supplies of food and material, overland to the stream at that place. After travelling by the shore for five hundred and fifty miles, they found themselves in open sea, and believed that their object was accomplished, but found, to their extreme chagrin, that they had only reached the commencement of a large gulf. Having only three days' provisions remaining, they mournfully decided to retrace their steps, and turned towards Hood river. "Short of food," says the narrator of this memorable voyage, "in a country deserted even by the few animals which supply the scanty larder of the Arctic voyager, ill provided with all that could facilitate their progress, eating the remains of their old shoes and whatever scraps of leather they had, obliged from exhaustion to abandon their canoes when they came to rapids, subsisting, at the last, upon rock tripe and the mosses which they could gather by the way, disappointed in finding assistance at a station where they had expected it, the sufferings of this party were almost unparalleled, and such as but few men could have endured. They lost two of their companions, and reached, in July, 1822, York Factory (their starting point), whence they had started three years before." In this time they had journeyed upwards of 5,500 miles, through obstacles, in weather, and with privations such as have seldom fallen upon men, even among the noble army of martyrs to scientific discovery.

There must be a feeling of gratification all over the world at the solution of this formidable problem. It has interested the civilized nations of the earth for nearly seventy years, expeditions having been fitted out, through all that time, to add to our scanty fund of information on the subject. And none can say that the labor, the money, or even the lives, have been ill bestowed in the cause. The bravery and self-sacrifice of the warrior has always been the favorite theme of the poet, and deeds of courage in the battle field have never lacked praise or poem; but a more imperishable and enduring glory is due to the peaceful traveller who risks his life in pursuance of the far higher duty of increasing our knowledge, and carrying the never fading banner of Science to the uttermost parts of the earth.

THE SALE OF PATENTED ARTICLES.

As we contemplate the few homely articles which form the outfit of an editor's table, it occurs to us to enumerate how many of these exist in their present convenient form solely on account of the stimulus of a good patent system.

To begin with, there is the inkstand patented. So is the ink it contains. So are the pen rack, the penholders, and pens. So are the ruler, the eraser, the blotter, and the paper fasteners. Yes, and so are the paper files, and the portfolio, and even the gas burner, by the aid of which, these shortening days, we are able to protract our labors somewhat into the dusk of evening.

All these things are good after their kind, and were purchased, as being most likely to be convenient for our use, out of many other patented articles.

If we, in the limited furniture of an editorial sanctum, can find ourselves so much indebted for comfort and convenience

to patented articles, surely it were not a hard task for the farmer, the artisan, and the housewife to count up a host of things which not only minister to their comfort, but without which they could scarcely now proceed with their business, and all of which have been patented. Very few of these things would have been produced without the hope of gain held out by the patent system.

Those who will take the trouble to see how many patented devices are in constant use by them, will certainly be better prepared to appreciate the value of patents in themselves, and will not be so ready to throw odium upon the system on account of the practices of an occasional fraudulent vender that infests rural districts.

It has been complained that there are many of these who pass through the country, under the pretence of selling rights to use or to make and sell patented articles of various kinds, but whose sole object is to defraud the simple, and to make money by dishonest practices.

Thus we have heard of a case where the exclusive right to make and sell a machine for a certain town was sold to three individuals in the same town. We have heard of other cases where parties, in signing a supposed agreement to pay a stipulated price for a machine at the expiration of a given time, under a proviso that certain results should accrue or the article should be returned, have signed negotiable notes which were sold at a discount, and which they were compelled to pay when the scoundrels, who took advantage of their simplicity, were far beyond their reach.

On account of these and other fraudulent practices, many have been victimized and become disgusted with patented articles; and now refuse to examine useful and important inventions, which it would be for their interest to purchase and use. This is as silly as it would be to denounce watches, because some rascals sell pinchbeck for real gold.

The utter absence of common and necessary precautions, in the transaction of all business, displayed by the dupes of fraudulent vendors, enables pretenders and cheats to bleed their purses. Let our rural friends never sign their names without being sure what they are signing, consult their lawyers as to the validity and intent of the contracts they propose to make, take the affidavit of parties proposing to sell patent rights that they are entitled to sell, and that the territory bargained for has not already been sold, and employ such other precautions as careful business men always use, and they will render the occupation of these land sharks very unwholesome, in a legal point of view.

That the simple and careless shall become the dupes of the shrewd and unscrupulous is in the nature of things. If a man should lie down to sleep in an exposed situation, and wake to find his pocket-book and watch abstracted by some prowling thief, he would scarcely blame anything more than his own folly. So if men attempt to execute contracts, and take upon them obligations of which they know nothing, without trustworthy advice, they must themselves take the burden of blame if they get swindled.

This, however, does not exonerate the swindlers. In many cases they might be brought to justice, were it not for indisposition to pursue and punish them. Such a course, though a duty to the public, protecting both honest sellers and buyers, involves some trouble, and it is much easier to "take it out" in maledictions against patents and all who traffic in them.

HOW TO PREVENT AND HOW TO EXTINGUISH FIRES.

The discussion of the proper building materials to use, and the best means of extinguishing fires, are, of course, the prevailing topics, just now, at Chicago. A correspondent, writing to one of the papers of that city, asks: "Have we any incombustible material that can be safely and economically put in the place of wood for these finishing works? Iron only is at present available, and with the present perfected processes of working, preparing, and finishing iron, we see no reason why it cannot be made equally acceptable in all these uses. If it were employed, the contents of a building, the goods and merchandise stored in it, might burn; but, except in the case of large quantities of highly inflammable material—as oils, spirits, etc.—could scarcely produce sufficient heat to materially damage the structure, and even then there would be no possibility of the fire extending beyond the building in which it originated. I believe that iron may be used, and our buildings be none the less ornate, none the less acceptable, all things considered. The only question to be discussed, then, under this head, is that of economy."

This correspondent's belief about the use of iron is correct, and has, for years, been in practice in most of the prominent cities, Chicago excepted.

The same correspondent says:—"Recent events prove that water, applied with all the skill and power men possess, is utterly useless to arrest the progress of flame under precisely those circumstances which most demand an efficient means of resistance to the fiery element. Certain gases have the effect of at once smothering and subduing the most violent conflagration by withdrawing the supply of oxygen. But here a difficulty presents itself. That which thus smothers a fire suffocates all living beings, and, for the same reason, to apply the gas, without its deadly result, is the problem for solution. This problem we commend, as we have done the first one, to the investigation of all who are interested in humanity, and can do ought to promote its study."

We suspect that the writer is not a reader of the SCIENTIFIC AMERICAN, and therefore perhaps not as well posted, in respect to the nature of the existing appliances for using water in cases of fire, as he might otherwise be. For example, on page 191 of our present volume, he will find illustrations of the Hall method of extinguishing fires by means of water directed through perforated pipes, which, at a small

expense, may be extended through any building. This system is extensively used in New England, and so valuable is it considered, that many of the insurance companies in that section will not insure a manufactory unless it is put in.

We know of several instances where large buildings, containing hundreds of thousands of dollars worth of property, have taken fire, but it was instantly extinguished by simply letting on the water. We call to mind no instance where the apparatus has failed. It puts out a fire in as many minutes as are often required in hours by the ordinary fire engines.

In our opinion, the Hall system of perforated piping ought to be placed in all large stores, warehouses, and buildings containing much inflammable material.

Where there is a proper supply of water, the use of this system comes about as near to perfect safety against fire as we can reasonably expect to attain.

THE PROPOSED EXHIBITION OF VIENNA, IN 1873.

We have been inclined to believe that the Exposition of Paris, 1867, was destined to be the last that the world would ever see of exhibitions, planned and accomplished on so gigantic a scale; but it seems that the Austrian Government is ambitious of trying its hand at the expensive luxury, and, as our readers are aware, has issued its prospectus for a great international exhibition, to be opened on the 1st of May, 1873.

It has been our rare good fortune to visit every one of the World's Fairs, in London, in 1851 and 1862, in Paris, in 1853 and 1867, in New York, in Dublin, and in Munich, and at each we have been astonished at the magnitude of the preparations and the importance of the results.

We observe that the Austrian Government intend to introduce several important new features, and to outstrip all of the preceding efforts of other countries. They propose to bring out, in special magnificence, specimens of the almost inexhaustible resources of the Indian Empire. This will be the strong point of the exhibition, as Eastern nations have never been fully represented, and there is great curiosity to see what they can produce. Another new feature is the intention to present the productions of all countries in groups corresponding with their geographical position. It is also proposed to represent a history of inventions, a history of prices, a history of industry, and a history of natural productions, "so that the world's progress in arts, science, industry, and natural products will thus be brought into contrast." The classification, of the objects to be exhibited, we have given in a former number, to which we must refer to avoid repetition.

Our object now is to call attention to the exhibition, and to impress upon inventors the importance of being well represented on an occasion that bids fair to attract a larger multitude of people than was ever collected together on any similar occasion. At the Paris Exhibition we were very poorly represented in quantity, but admirably in quality. The few articles sent over from this country attracted great attention; nearly every one received a commendatory notice, and it would be interesting to know how much business grew out of this small show. Americans felt that there were many omissions, and, for the credit of this country, as well as for the good of society, they were sorry to observe this want. The mistakes of 1867 ought not to be repeated in 1873. We ought to begin at once in the organization of committees and commissions to take the matter in charge, so that, by circulars and special effort, a majority of our best things may be forwarded to Vienna. We doubt if any good article need be brought back, and it is impossible to predict the extent of trade that is likely to grow out of such an extensive notice as the Fair will give to all exhibitors.

The inhabitants of the populous countries of the East will be present in large numbers. It is notorious that they have great need of many mechanical contrivances; and as, on the seaboard and in large cities, they have already called for a large number of steam engines, they will be apt to order many minor articles for the interior, and offer their own rich wares in return.

We remember what crowds of people gathered around the sewing machines at the Paris Exhibition of 1855. It is almost incredible that the woman to work the machine had to be sent out from America, as there was no one in Paris who understood its management, and yet it is true. The sewing machine was seen by several hundred thousand people, and out of this Exhibition has grown an enormous industry.

American pianos took the prize over all others, in 1867, and the consequence has been heavy orders from Europe. But it is in the thousand and one little inventions adapted to supply the wants of every day life that we excel. Such articles appear to be too insignificant to be sent abroad, and yet they are exactly what they need in Europe. If the preparation of a list of desirable objects to be sent were to be entrusted to a proper committee, some system could be thrown into the selection of objects, and there would be less danger of important omissions. A central advisory board, composed of twenty-six experts, representing the groups into which it is proposed to divide the Exhibition, could be organized in New York, and they could cull out the best articles in each department. The labors of such a commission would be productive of much good, and we dare say that a sufficient number of desirable men could be found willing to work in so good a cause.

At the time of the last Paris Exhibition, an advisory committee was organized in New York, and all of the articles to be forwarded were examined and passed by them; this committee also induced several manufacturers to send forward their inventions for the sake of doing credit to our country.

It may be more difficult to send bulky articles to Vienna than it was to Paris, but we have no doubt that the Austrian Government will seek to obviate this disadvantage by grant-

ing peculiar facilities to all persons who send from a great distance.

The experience we acquire in getting ready for the Vienna Exhibition will be of service in preparing for the great centennial celebration, to take place in Philadelphia in 1876.

It is the characteristic of the age that good things are not hidden away, and the chief benefit of international fairs is to make known what one people produces and what another wants. The Vienna Fair will be a grand opportunity for advertising our good things, and it ought not to be neglected.

FIREPROOF BUILDINGS FOR PRESERVING PUBLIC RECORDS.

The insecurity of public documents and records is one of the painful reflections forced upon us by the recent fire in Chicago. Our readers will find in another column an account of the character of the public buildings that were destroyed in that ill-fated city.

The building that contains the records in the city of New York is, though nominally fireproof, only so by virtue of its isolation from other structures, and no doubt the majority of such buildings throughout the country are equally insecure.

In connection with the statements of the *Chicago Tribune*, relating to the shabby character of the Post Office, Custom House, and Sub-Treasury buildings that burned, we may profitably consider some statements in regard to the New Record Office, in London, and to methods of fireproofing buildings employed in Europe.

The Record Office, in London, is built wholly of iron and stone. It has no room larger than seventeen feet by twenty-five feet, and seventeen feet high. None of these rooms communicate with any other in the building. Each opens into a vaulted hallway. The doors are iron. The contents of any one room might burn without endangering those of any other in the building.

The use of wood in building for such a purpose ought to be strictly prohibited; then, if partitions were made sufficiently thick, and they were generally constructed on the plan of the London Office, the public records would be probably as nearly safe from fire as it is possible to make them.

How many more severe lessons are necessary to teach us wisdom? There are ways and means, cheap and available, for making buildings that will resist the progress of a fire, even if they will not withstand such heat as was generated by the united burning of the wooden buildings of Chicago. The French have a way of filling in the spaces between timbers, in partitions, with rubble and plastering. There are, in this way of building, no passages for flames through walls. In a very common way of constructing partition walls in this country, with lath and plaster upon studs, the whole building is a series of flues through which flame will rush the moment the plaster wall is crumbled by the heat.

The French method of filling partitions is employed in other parts of Europe. Houses thus constructed are almost as fireproof as if built of brick throughout.

We need not allude here to the many patented devices, calculated to increase security against fire, which have been described in our columns, since they have thus been rendered familiar to our readers. The plain truth is that, with plenty of resources, we have been building throughout the country in a manner disgraceful to a nation whose progress has been so rapid in other respects. Let the lessons we have received teach reform in this matter, and the pecuniary damage sustained will be in great measure compensated for.

SCIENTIFIC INTELLIGENCE.

CONTRIBUTIONS TO OUR KNOWLEDGE OF CARBON.

Berthelot states that the specimen of meteoric iron from Cranbourne, near Melbourne, Australia, contains, among other foreign constituents, fragments of pyrites and amorphous carbon, which latter is generally called graphite. The author concludes, from the behavior of this carbon to nitric acid, or to a mixture of this acid and chlorate of potash, that it is identical with the so called graphite contained in cast iron, but not with native graphite. All of the oxidation products of the meteoric carbon exhibit the same properties as the products of the oxidation of cast iron carbon, differing, however, from what can be obtained from graphite. He infers that the carbon of the Cranbourne meteorite was dissolved in the fused mass of iron, and separated on rapid cooling. From the coincident occurrence of pyrites, he concludes that the carbon comes from the decomposition of bisulphide of carbon by the glowing iron, and not from carbonic oxide. And he sustains this conclusion by acting, upon carbon thus prepared, with nitric acid and chlorate of potash, and finding that it is almost entirely dissolved, the same as the carbon from cast iron. From these experiments, it appears to follow that the native graphite cannot have been originally separated from iron, because it differs entirely from the carbon thus prepared. It is equally improbable that the natural graphite originated from anthracite or from the decomposition of organic substances, as the carbon thus produced does not yield graphitic acid. The author states that true graphite can be obtained by acting upon bisulphide of carbon at a high heat. If his conclusions are correct, the carbon from cast iron is not the same thing as graphite, and we must look to the decomposition of some such compounds as the bisulphide of carbon, or possibly of cyanogen, if we wish to discover the probable origin of graphite. Berthelot some time since prepared the compound of carbon with hydrogen, known as Marsh gas, by passing a mixture of bisulphide of carbon and sulphuretted hydrogen over metallic copper contained in a porcelain tube heated to redness. It would be well for future investigators to employ the method

for the determination of carbon, described in the October number of the *American Chemist* by Mr. Cairns, of the Columbia College School of Mines, namely, by oxidizing directly with chromic and sulphuric acids.

A NEW CONSTANT BATTERY.

Figuer recommends, for the construction of a constant battery, a special preparation of the carbon which will work with one liquid, namely, dilute sulphuric acid. The carbon pole is coated with a thin layer of porous platinum or of silver. To accomplish the first operation, the carbon is brushed over with a solution of chloride of platinum, dried and exposed to red heat. To coat with silver, the carbon is soaked in a solution of nitrate, then suspended in an atmosphere of hydrochloric acid gas, and heated to free the chloride of silver thus produced. This chloride is subsequently reduced by the hydrogen gas that is evolved. Carbon thus prepared is said to give a constant current in dilute sulphuric acid.

CHEMICAL ACTION OF LIGHT.

M. Morren advances, as the result of numerous experiments, the following hypothesis: All chemical reactions occasioned by sunlight can be divided into two classes; the first class, characteristically represented by sulphuric acid, includes those bodies which are chiefly formed by the heat rays; the second class, represented by hydrochloric acid, includes such compounds as are produced by the action of chemical rays. The research is an important one, as the action of heat in determining chemical reactions is not sufficiently understood. The practical application of our knowledge of chemical rays to photography has led to a closer study of this branch of the subject; by the same industry, applied to heat rays, we may arrive at heat pictures and other interesting applications of this department of physics. A good many hidden changes in chemical compounds may possibly be traced to the action of the thermal rays of light.

VEGETABLE CEMENT.

A good vegetable cement may be prepared by mixing gum arabic with nitrate of lime. The latter is prepared by dissolving an excess of marble in nitric acid, and filtering. The filtered solution will contain 33.3 per cent nitrate of lime, which may be dried by evaporation. For the cement, take two parts by weight of the nitrate of lime, twenty parts of pulverized gum arabic, and twenty-five parts of water. The mixture can be further diluted to adapt it to the uses to which it is to be applied. In the manufacture of artificial stone, a cement of a similar character has been found to serve a good purpose. Something of the kind is used in the Frear stone, but in the *Béton-Coignet* no additional binding material is found necessary.

PRESERVATION OF MEAT.

By repeatedly immersing the meat in hydrochloric acid, subsequently drying, it is sufficiently cured to keep for a considerable time. When required for use, the acid must be neutralized by a little carbonate of soda, by which it will be salted. The strength of the hydrochloric acid must be determined by experiment.

PRESERVATION OF WOOD.

Armand Muller has instituted some interesting experiments upon this interesting subject, and arrives at the conclusion that the phosphate of baryta, formed by the mutual decomposition of phosphate of soda and chloride of barium in the pores of the wood, is one of the best preservative agents available to chemists. For the purposes of the experiment, Muller took twelve pieces of green oak wood, four inches long and one and a half inches in diameter, which he buried for twelve months, after suitable impregnation, in constantly moist earth, near a manure pit. One piece was left without any protection, for purposes of comparison.

No. 1, coated with tar, showed signs of mold and decay.

No. 2, impregnated with a mixture of light and heavy tar oils, containing three to four per cent of creosote, was only tolerably protected.

No. 3, with chloride of calcium, worthless.

No. 4, with chloride of barium, badly decayed.

No. 5, in a solution of borax, and afterwards in a solution of chloride of barium, was covered with mold and decaying.

No. 6. Soak the wood five days in a seven per cent solution of phosphate of soda, and after drying, suspend in a thirteen per cent solution of chloride of barium for seven days. The author thinks that wood thus prepared will withstand the action of moisture better than with any other preparation. The chief obstacle to the use of such chemicals is in their cost. He found the test piece of wood nearly as hard and unchanged as if it had not been buried at all.

No. 7 was separately soaked in solutions of sulphate of iron and soluble glass; result, tolerable.

No. 8. Soda, soap, and sulphate of copper. The wood was perfectly well preserved. This result suggests experiments upon ships' bottoms with such a mixture, as the poisonous effects of the copper would kill the boring worm, while it preserved the wood from decay.

No. 9. Soda, soap, and hydrated chloride of aluminum (chloralum); wood tolerably preserved.

No. 10. Chloride of zinc; this is well known to be one of the best wood preservers.

No. 11. Sulphate of copper, also well known.

No. 12. Corrosive sublimate; same as the last. Mercury salts have long been used as antiseptics.

No. 13, without any preparation, was entirely rotted and useless.

The best results appear to be attained whenever two antiseptic mineral salts mutually decompose each other in the pores of the wood, coagulate the albumen, and exclude the water; and in searching for good wood-preserving material,

this reaction should always be kept in view. Phosphate of soda and chloride of barium, alternately applied, appear to yield, upon the whole, the most satisfactory results.

EXTRACTION OF OIL BY PETROLEUM.

The extraction of oil from seeds, by some volatile solvent instead of the usual hot or cold press, is constantly receiving more attention, partly because the yield of the extracted oil is found to be greater, and partly because the quality of the oil is better, without any diminution in the value of the cake for fodder. The light oils of petroleum appear to have certain advantages over bisulphide of carbon for the preparation of table and lubricating oils. In the treatment of the cacao bean, as the theobromine is not soluble in petroleum, all of the butter is removed without destroying the aroma, and the broma remains in the residue. Petroleum can be applied to the removal of fat from bones, and it leaves the bones perfectly clean and white, in which condition they are admirably adapted to knife handles, and take colors more readily. The oil and fat can at once be applied to the manufacture of soap or candles without further purification, and the yield of glue is increased. Several patents have been taken out for contrivances for extracting oils by means of petroleum, naphtha, and bisulphide of carbon; but they do not appear to be well known, as the fat boiling nuisance still continues. It is a curious spectacle to witness the wasteful and disgusting method of recovering fat, pursued in large cities, when a cheaper and more economical way is at hand. So also in pressing linseed, a large amount of oil remains in the cake, which would be saved if the extraction were to be conducted in a chemical way. We again call the attention of inventors to this important subject.

RECENT PATENT DECISIONS.

In the matter of the application of Timothy F. Taft for the extension of letters patent No. 18,025, for shears for cutting metal, granted him August 18, 1857.

The decision first prepared in this case was as follows:

The invention sought to be extended consists of shears for cutting metal, so constructed that the upper edge of the movable blade constitutes the inclined plane on which the wheel travels, while the wheel itself is compelled in its movement of translation to follow a horizontal direction by means of a horizontal plane in the opposite side of its circumference, and a supplementary wheel interposed between them. The bearing surfaces of the two wheels and two planes are plain, and, to avoid slipping from want of proper traction, the wheels and planes have several cogged plates attached to them which mutually interlock.

Affidavits have been filed of three intelligent and apparently disinterested persons, as well as the affidavit and statement of the patentee, and they all agree in representing the machine in question as enabling a man to accomplish one third more work in a given time, and as doing the work better and with more ease than any other machine with which they are acquainted.

The examiner in this case reports:

"After a careful examination of the application, it is believed that the invention was new at the time the patent was granted; that it is valuable, and important to the public; that the patentee has not been reasonably remunerated, and that his failure to be so remunerated has arisen from no fault or neglect on his part."

From the examination of this case, I am satisfied all the requirements of the law have been complied with, as relates to extension, and accordingly the prayer of the petitioner is hereby granted.

Subsequently this decision was recalled, for reasons which appear below, and a new one rendered, as follows:

LEGGETT, Commissioner:

Upon the hearing of this case, it appeared, upon the records of the Office, that the patentee, Timothy F. Taft, had assigned all his interest in and to said patent, including the extension, if granted, to one Lucius W. Bond, by assignment, dated November 22, 1867.

I called the attention of the attorney to this matter, and informed him that the Office would not extend patents for the sole benefit of assignees, and could not, under the law. He then said that said assignment was given to Bond in the nature of a mortgage, to secure borrowed money, and that on June 13 last, Taft had settled the matter, and on that day the patent was reconveyed to Taft; but that he had neglected to have the reassignment recorded. The attorney then took the reassignment from among his papers, and had it put upon record, and assured me that it was a *bona fide* document, and that the whole title was then in Taft, and upon this assurance and belief the decision extending the patent was made.

As soon as the decision was made, the attorney took from his pocket another assignment from Taft to Bond, also bearing date June 13, 1871, and filed the same for record, thereby falsifying the statement that the title in the extension was in Taft, and further showing the reconveyance to Taft was a mere fiction to deceive the Commissioner of Patents.

The records of the Office further show, that on the 23d June, 1871, Taft also assigned all his right, title, and interest in the extension, to one Elizabeth H. Taft. He comes to the Office for an extension, and assures the Commissioner that he has, in his own right, the entire interest in the extension, while, in fact, the records of the Office show that, in June last, he sold for a merely nominal price to two distinct persons, by two separate assignments, all his interest in the extension, if granted.

In view of these facts, the former action of the Office granting extension in this case is revoked, and the extension is refused.

DAVID H. MORRISON'S PATENT.

In the matter of the application of David H. Morrison for letters patent for an improvement in iron bridges.

CARTER, Chief Justice:

In the case of the petition of David H. Morrison for improvement in iron bridges, on appeal to this court from the decision of the Commissioner of Patents, the court have come to the conclusion to grant him a patent. The whole case is to be found in one consideration outside of the opinion of the Commissioner of Patents; or rather, is to be found inside of it.

"The applicant originally presented four claims," says the Commissioner, "and exception was taken to the first and fourth. The fourth was erased, and the first is now the only one in controversy. It reads as follows: 'The construction of the arch or top chord of the bridge by the use of the iron I beam, when arranged therein with its double flanges in vertical plane, substantially as described, for the purpose specified.' This claim was rejected by the primary examiner upon references which the board of examiners-in-chief do not think pertinent; but they go on to declare, in effect, that, the

I beams having been used in bridges or other structures with double flanges in horizontal planes, it did not involve invention to arrange them with the flanges in vertical planes."

The Commissioner proceeds:

The applicant suggests certain advantages which will arise from his new arrangement, among others that the frames and truss work can be more readily attached to the arch or top chord, and especially by this arrangement the tendency to lateral flexure is resisted without the necessity of cross timbers, while the tendency to vertical flexure, being less considerable, is not increased.

These advantages, I am of opinion, are substantial, especially the latter; and if the applicant was the first to obtain this result, the improvement might well be construed to be not for turning an I beam upon its side, but for the construction of the arch or top chord of a bridge, with a broad horizontal web to resist lateral flexure. This, if new, is useful, and I think patentable. It is, however, not new.

The arch exhibited in the withdrawn application of Penniman & McGlacklin shows a broad, horizontal web, which possesses the advantage of applicant's beam, and differs in nothing from his, except the fact that the upper flanges on each side are wanting. The web and lower flanges, as represented, perform the precise office of the same part in applicant's. The upper flanges merely strengthen the whole structure, and this reference anticipates the principle which is supposed to underlie the alleged invention, and, as the idea itself is old, reduces it to a mere application of an old device to an old purpose.

Now, the Office or the Commissioner disposes of everything connected with this patent except one reference, and that is the reference of the rejected application of Penniman & McGlacklin. He says that, inasmuch as the invention is anticipated in the one referred to, which was rejected, it is not new.

Now, this question of identity, or of difference, is a question of fact—a question in mechanics—and one to be determined by inspection. There is no other way of reaching it. The model of the rejected patent has been before us, and it has been fully examined and considered by us. From such examination, which was a careful and a thoughtful one, the court have come to the conclusion that it is not like the one for which a patent is now being sought, either in form or principle, or indeed in the mode of manufacturing. The only resemblance between the two consists in the former being made to perform, under a different arrangement, the same office that this arch is made to perform.

In the first place, the reference made here is a reference to a cast iron bridge—a bridge that could not be made of wrought iron. It is not an I beam in any sense, and could not be tortured into one. It is not the web of the I beam. Instead of the web between the flanges on either side, it is an open chamber, with links connecting it. It is not uniform in its size. The principle of that arch is a broad base at either bearing with a view of preventing lateral flexure, with a gradual withdrawal of the base until you arrive at the center of the arch. So that this support, the support of the vertical position of the arch, is designed to be maintained by this gradual spreading out of the arch to its base. Here the arch is uniform, and does not depend on such contrivance for its support.

Again, that is an arch, made in the form in which it is made, that could not be forged out of wrought iron. No machinery could make it; at least, the rolling process, by which wrought iron is reduced to shape in the I beam, could not be applied to it. It is not in the power of mechanics to roll out wrought iron in a diverging or expanding form; and grooves and dies of the roller must necessarily be uniform. Neither in the material, the form, the conception of the arch, nor the design of its peculiarities, is it identical with the contrivance in the application before us.

And that disposes of the whole case, for the Office enlightens us that, in every other particular, this application is worthy of a patent; and in this particular the Commissioner, although a very able man, an experienced patent lawyer, and a sharp, quick observer, must have come to this conclusion without looking at the reference that brought him to it.

The decision of the Commissioner is reversed, and a patent ordered to issue.

A Talking Machine.

The old talking machine of Faber is again on exhibition at Philadelphia, and is thus described in the *Post* of that city:

Previous to an experimental illustration of the wonderful powers of the machine, Dr. J. Solis Cohn delivered an exhaustive lecture upon the anatomy of the vocal organs and the formation of sound, the structure of the machine, and concluded with an historical sketch of the invention.

It was originated about thirty years ago by the uncle of Professor Faber, and exhibited at the time in that city. The present Professor Faber improved it wonderfully, although it took a great while to arrive at the present perfection. Seven years were necessary to arrive at the production of the sound of the letter "e." The exhibition last night consisted of the pronunciation of all the letters of the alphabet and elementary sounds of our language. Phrases of six and eight words in length were spoken in the English, French, and German languages. The voice is a shrill, monotonous, and unnatural one, but in the majority of instances startlingly correct. It was operated by a German lady, who does not understand a word of English, and produces the sounds simply through phonetic translation.

The happy pronunciation of a word or phrase was received by the audience with applause. If there is, in our estimation, any sound that is slurred in the slightest, it is the sound of the letter "i." It must be remembered that the basis of speech of this machine is the sound system of the German language, and that all the English words are spoken with a German accent. The machine is constructed as follows:

The machine consists of a gilded table, highly ornamented beneath which appears a bellows and a lever to put it in motion. Upon the top a lifeless face, with clammy eyes, stares on you, and behind it is arranged a mass of wires, strings, delicate wooden levers, rubber tubes, and pipes, which make up the speaking apparatus. By a compression of the bellows, the air is forced through a narrow aperture into an iron windpipe, and thence into an artificial glottis, from which it passes through a vent representing the human mouth, with movable jaws and rubber tongue. There are fourteen levers, which gives each a distinct utterance, and when moved in concert they produce the sound of any desired syllable. A separate lever causes a peal of laughter, which would be natural enough except for a slightly grating noise.

Are the Andes Sinking?

It is a singular fact that almost every successive measurement of the Equatorial Andes gives a reduced altitude. Thus:

Quito, according to	La Condamine (1745)	is 9,596 feet.
"	Humboldt (1803)	" 9,570 "
"	Boussingault (1831)	" 9,567 "
"	Bureau des longs. (?)	" 9,540 "
"	Prof. Orton (1867)	" 9,520 "
"	Reiss and Stübel (1870)	" 9,350 "
Pichincha	La Condamine (1745)	" 15,606 "
"	Humboldt (1803)	" 15,922 "
"	Prof. Orton (1867)	" 15,827 "
"	Reiss and Stübel (1871)	" 15,704 "
" crater "	Moreno & Wisse (1844)	" 13,600 "
" " "	Prof. Orton (1867)	" 13,300 "
" " "	Reiss and Stübel (1870)	" 13,175 "
Antisana hacienda	Humboldt (1803)	" 13,465 "
"	Boussingault (1831)	" 13,356 "
"	Prof. Orton (1867)	" 13,300 "

This shows an apparent subsidence of Quito of 246 feet in 125 years, and of Pichincha, 218 feet. Its crater has apparently subsided 425 feet in the past twenty-six years. Antisana has subsided 165 feet in sixty-four years.

The Recent Discovery in the Arctic Regions.

A fortnight since, we informed our readers that the long cherished idea of the existence of an open sea surrounding the North Pole had been verified by the German explorers. The travelers Payer and Weyprecht have reached this region, in accordance with the suggestion of Captain Bent, by pursuing the course of the Gulf Stream, the warm current of which, he supposed, would lead to the gate of the frozen regions.

The scientific world will look eagerly for detailed accounts of this prodigious event in the history of the physical study of our globe. In the meantime, Captain Hall, in the *Polaris*, is pursuing the investigation through another channel, and, by our last accounts, was progressing rapidly towards his object.

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 100 a line, under the head of "Business and Personal."

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

J. H. P., of N. Y.—There have been stories about the late shifting of the Gulf Stream, but no such stories have been authenticated.

E. V. N., of Ohio.—General George B. McClellan, 348 Broadway, New York, is the Chairman of the New York State Commission on Erie Canal Navigation.

HEATING SURFACE OF BOILERS.—A. H. G. can apply the rules for measuring cylindrical surfaces (which the *SCIENTIFIC AMERICAN* has recently given with such generous profusion) to his own particular case. A slight knowledge of arithmetic only is required.—D. B., of N. Y.

FISH IN LIMESTONE WATER.—Trout thrive well in limestone water, and if A. B. wishes to stock his pond and keep the fish in good condition, he is fortunate in having a never failing stream such as he describes. The brook trout will not do well unless the water be constantly running.—D. B., of N. Y.

SHAMPOOING THE HAIR.—H. L. J. will find, if he will break an egg into his hair, and shampoo his head with it, just before going into the bath tub, that it will cleanse his scalp better than any shampoo mixture that is sold. I have used eggs for washing the hair for fifteen years.—F. S. C., of Mass.

FIREPROOF PAPER.—In answer to C. G. A., query No. 2, Nov. 4, newspapers can be rendered fireproof by dipping in diluted 25° B. soluble glass, by first neutralizing the alkali by diluted muriatic acid of 10° B. while hot, and drying by the atmosphere. Fire cannot then destroy the texture of the paper. C. G. A. may be sure of success with a little care.—J. W. F., of N. Y.

FIREPROOF CLOTH.—In answer to C. G. A., query No. 3, Nov. 4, tents, awnings, canvas, etc., can be made fireproof as well as waterproof by the careful application of soluble glass. First dilute it with boiling water to 25° B. by hydrometer, before thoroughly dry, immerse in a solution of sulphate of alumina (alum cake) and sulphate of copper (blue vitriol) consisting of one part of each to ten parts of water. The fabric cannot be impaired by slowly drying by atmosphere.—J. W. F., of N. Y.

SOLUBLE GLASS.—In answer to W. J., query No. 6, No. 4: The article you purchased in San Francisco was the silicate of soda or liquid quartz, only used by soap boilers for cheapening and hardening their grease. The right article is soluble glass (water glass or liquid silicic acid), of a sirupy consistency (80° B.), of clear, transparent straw color, used expressly for cements, stone, etc.—J. W. F., of N. Y.

CLEANING BRASS.—I saw in the last number of the *SCIENTIFIC AMERICAN* several methods for cleaning brass. I have seen no smoother, brighter brasses than those on our locomotives, and they are cleaned thus: Rub first with a piece of dirty cotton waste, and polish with clean waste and soot from the furnace door. We use bituminous coal. For the dirty waste, use that first used to wipe the dust and oil from the engine. If G. N. K. will try this, he can have bright smooth brasses at small cost. All emery and such substances scratch the brasses and destroy the hard, smooth surface which is the very thing required to be maintained.—W. G., of W. Va.

DRYING ROOM FOR CLOTHES.—J. J., page 282, No. 18, current volume, can easily and cheaply improve his drying room as follows: If there is an unused chimney flue in the room, cut an opening into it, of the full size of the flue, about one foot high from the floor. If there is no chimney, make a draft flue of wood, tin, or stovepipe, the larger the better, and the higher the better, but let the opening be low down in the room. At or near the level of the floor, introduce the fresh air, by any convenient opening sufficiently large to supply the draft pipe fully. This is preferably placed near the heating pipe. The lower down the heater is placed, and the cold air is admitted, the better. The fresh air, being warmed, has an increased capacity for moisture; it rises to the ceiling, is diffused there, and forces down the cooler particles of air in the room, cooling itself and being forced down in turn, and escaping, laden with moisture, through the draft pipe, as may be easily seen by holding the flame of a candle at the opening. It is a common error to make the opening of the escape flue, near the ceiling, whenever ventilation is intended to get rid of either carbonic acid gas or moisture; but in this case the hot air travels in a direct current, escaping before half its work is done, and out of the direct current, scarcely doing any work at all.—J. H., of O.

PUMPING WATER FOR LONG DISTANCES.—M. H. P. asks, through your journal of October 28th, information about the mode of conducting water from his well, 145 feet from his house. A suction pump will raise water a height of 33½ feet (perpendicular); 10 feet horizontal is equal to one foot perpendicular. So that the same pump will bring water 33½ feet horizontally, although in his particular case it will not operate, because he has 145 feet horizontal and 20 feet perpendicular, which makes over 54 feet. There will be great difficulty experienced in exhausting the air out of a long pipe; the best way is to have your packing boxes very tight and charge your pump. For a long horizontal pipe for pumps, wood will not give much satisfaction. Lead is best and cheapest. Query No. 7, in same paper, in reference to air pump, interests me. I would like to hear from somebody about it.—M. W. Q., of Mo.

FLOATING OF SOLID IN MOLTEN IRON.—In answer to the query of S. H. W., concerning the cause of solid floating on molten iron, permit me to suggest that the probable cause is not the attraction of cohesion in the latter, as has been suggested; although this might prevent it from becoming immersed, but when once immersed it is evident that it would not cause it to rise to the surface. Hence, there can be but one cause, namely, the solid must be less dense than the molten—an apparent exception to the laws of expansion and contraction by heat and cold, but no real exception. Another force is evidently brought into play, which masks the regular action of the heat, and there can be little question that the play of crystalline forces interferes with the result; since, in all liquids which crystallize when they congeal, as water, bismuth, iron, etc., as they approach solidification, there is a rearrangement of the molecules with enlarged interspaces and consequent expansion.—C. E. S., of—.

HOW TO CLEAN SHELLS.—Make lye by boiling strong ashes, allow it to settle; pour the lye over the shells, and boil them six or seven hours, or longer if they are large; then soak and wash often in fresh water.—E. E. S., of—.

FRENCH POLISH.—Let W. B. W. take of ordinary shellac two ounces, bruise it as fine as flour, put it into a pint of spirits of wine in a bottle, and shake it continually until dissolved. It will take a good half hour to dissolve it. Then strain it, and if too thick, add more spirits of wine. Do not use too much raw linseed oil, as it causes the polish to be spotted with white, especially when finishing off the work. The spirit should not be too strong, lest it should crack, and not too weak, lest the work should not be good.—P. K., of N. Y.

INCORUSTATION IN BOILERS.—E. L. F. asks how he can prevent incrustation in his boilers. The only effectual remedy is to blow out frequently. I blow out once a week at least ten per cent of the water in the boilers. It should be done while the water is at rest, that is, before starting in the feed water. Our boilers were badly incrustated. We loosened the scale with chisels and kerosene oil, and, after running them a year as above, they came out as clean and bright as could be.—S. H., of N. Y.

SPONGY PLATINUM.—T. M. can make platinum sponge by the following process: Dissolve platinum, by the aid of heat, in a mixture of three parts nitric and five parts muriatic acid, avoiding great excess of acid. To this solution add a strong solution of muriate of ammonia; collect the resulting precipitate on a filter, and when nearly dry, form it into a mass of the shape desired for the sponge. Heat this to whiteness on charcoal, with the blowpipe or otherwise, and the platinum remains in the spongy state. Its characteristic properties may be restored, when lost, by simply heating it to redness.—C. L. R. S., of D. C.

SCALE IN BOILERS.—Let E. L. F. get some cow or ox feet, just as they are cut off in the slaughter house, put them in a wire net fine enough to detain the small bones from getting into the blow-off pipe, into boiler. He should use five feet to a six horse boiler, and he will have no further trouble with scale in his boilers. If he has glass gages, he will find that they will not make the water foam. I have used them for upwards of ten years in plain, Cornish, and multitubular boilers. According to the quality of water, he will have to replace them every two or three months. He can clean a boiler in about half an hour after he gets it once clean.—J. A., of Pa.

PREVENTING GRANULATION OF SUGAR.—In answer to Query No. 5, in SCIENTIFIC AMERICAN, Nov. 4th, I have to say that confectioners add a little cream of tartar to the sugar to prevent granulation.—I. I. H. of Ky.

DESTRUCTION OF TREES.—Take rain water as much as necessary to kill a given number of trees; and use as much sulphate of iron in it as the water will dissolve when hot.—A. K., of Pa.

Examples for the Ladies.

Mrs. M. L. Sloper, Cottonwood Falls (formerly of Leavenworth), earned, in dressmaking, with a Wheeler & Wilson Machine, in 6½ months, \$15,340; in 1866 she earned \$4,230; in December, 1867, \$435. The machine has been constantly employed since 1861 without a cent for repairs.

Mothers and Nurses.—Burnett's Kalliston is admirable for the sensitive skin of infants.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Business in Boston wanted by an energetic young man with capital and first class references. Address F. Carlton, P. O. Box 1268, Boston.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$1 00 a year. Advertisements 17c. a line.

Inventors of Saw Filing Machines, please send circulars to Post Office Box No. 73, Salem, New Jersey.

Wanted, in good order, the following second hand machinery: One Drill Press, with at least two drill spindles—one Hand Milling Machine—one Power Lathe, for light turning. Address E. B. B., Box 119, Newburgh, N. Y., with full description and price.

The best and cheapest Self Oilers are manufactured by Holland & Cody, 8 Gold Street, New York. Send for price list.

Hafner's Patent Eureka Coil Spring for Mill Spindles, is the only Spring constructed on scientific and the rotary principle. Mill-furnishers, millwrights, and millers, send for circulars and satisfy yourselves. Sample spring sent on trial to reliable parties. John A. Hafner, Santa Fe, Ill.

Land sufficient for the purposes of any good manufacturing business, and most admirably located on the Poughkeepsie & Eastern R.R., with plenty of water for steam purposes at hand, and only fifteen minutes' walk from the center of the city, will be given to any parties who meet the views of the owner. Address P. O. Box 534, Poughkeepsie, N. Y.

Tested Machinery Oils—Kelley's Patent Sperm Oil, \$1 gallon; Engine Oil, 75 cts.; Filtered Rock Lubricating Oil, 75 cts. Send for certificates. 116 Maiden Lane, N. Y.

Use Soluble Glass for fireproofing Wooden Pavements, Shanties, R. R. Bridges, also as common hardening Mortar and Cements, makes most durable Stove and Foundry Patty, Iron Cement. Apply to L. & J. W. Feuchtwanger, Chemists, 55 Cedar street, New York.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms \$4.00 a year.

For Best Galvanized Iron Cornice Machines in the United States, for both straight and circular work, address Calvin Carr & Co., 26 Merwin St., Cleveland, Ohio.

Francis Schleicher, Consulting, Analytical and Manufacturing Chemist, Laboratory, Newark St., between Jackson and Harrison St., P. O. Box 172, Hoboken, N. J.

One "Scott's Wheel Moulding Machine," saves \$5,000 yearly in patterns—wheels absolutely perfect. Engraving sent free. Hamilton E. Towle, 176 Broadway, New York.

Portable Farm Engines, new, and beautiful design, mounted on Springs. Compact, light, and efficient. Send for descriptive circular. Mansfield Machine Works, Mansfield, Ohio.

For the best 15 inch Eng. Lathes, Bench Lathes, or Friction Pulleys, address John R. Abbe, P. O. Box 345, Providence, R. I.

75 horse power Engine and Boiler, complete, for sale cheap. R. H. Norris, near West Street Bridge, Paterson, N. J.

Kelley's Chemical Metallic Paints, \$1, \$1.50, \$2 per gallon mixed ready for use. Send for cards of colors, &c., 116 Maiden Lane, N. Y. For sale: A Geometrical Lathe for heavy square, round or oval engine turning and combination wave line work. A. Schaefer, 22 Forsyth Street, N. Y.

I want the address of every cabinet maker and every painter in the world. J. Henry Symonds, P. O. Box 57, Boston, Mass.

Wanted—a sober, industrious man, who is fully competent to take charge of a sash, blind, and door factory. Address Wm. B. Houghton & Son, Little Falls, N. Y.

Stencil Tools & Steel Letters, J. C. Hilton, 66 W. Lake St. Chicago. To Boiler Makers—Water Gauges sold cheaper by us than any other House in the Country. Holland & Cody, No. 8 Gold St., N. Y.

Baxter's Adjustable Wrenches fit peculiar corners where no other will work. All first class mechanics need one. Baxter Wrench Co., 18 Park Place, New York.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Shoe Peg Machinery. Address A. Gauntt, Chagrin Fall, Ohio.

We will remove and prevent Scale in any Steam Boiler, or make no charge. Geo. W. Lord, 107 Girard ave., Philadelphia, Pa.

Builder's Scaffold—Patent for Sale—For further particulars, address Redick & Kunkle, Butler, O.

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

The Oil used on all the Machinery at the A. I. Fair is from Chard & Howe, 134 Maiden Lane, New York. Ask them how it works.

Walrus Leather, for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

Kelley's Pat. Petroleum Linseed Oil, 50c. gal., 116 Maiden Lane.

Turkey Boxwood pieces for Sale, suitable for engravers and fancy turners' use. Address Stephens & Co., Riverton, Conn.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

The best lubricating oil in the world is Winter pressed Sperm. Sold in bottles, cans, and barrels, by Wm. F. Nye, New Bedford, Mass.

Vinegar—how made—of Cider, Wine, or Sorgo, in 10 hours F. Sage, Cromwell, Conn.

Best Oak Tanned Leather and Vulcanized Rubber Belting. Greene, Tweed & Co., 18 Park Place, New York.

To Cotton Pressers, Storage Men, and Freighters.—35-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 35 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water St. New York.

Brown's Coal-yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water St., N. Y.

Presses, Dies, and Tanners' Tools. Conner & Mays, late Mays & Bliss, 4 to 8 Water St., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

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

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

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Blake's Belt Studs. The cheapest and best fastening for Rubber and Leather Belting. Greene, Tweed & Co., 18 Park Place, N. Y.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 21 and Nov. 23, 1869. 64 Nassau St., New York.

Railway Turn Tables—Greenleaf's Patent. Drawings sent on application. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. For circulars address the sole manufacturers. Milo, Peck & Co., New Haven, Ct.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

BOILER EXPLOSIONS.—J. F. K.—R. A. W.
IS THE BRAIN THE ORIGIN OF THOUGHT, ETC.—B. H.
NAMES OF PLACES.—C. I.
NARROW GAGE RAILWAYS.—D. O.
PAINE'S ELECTRO-MOTOR.—J. E. S.
PROLONGING LIFE.—
PUBLIC SUPPLY OF POWER.—F. G. W.
ANSWERS TO CORRESPONDENTS.—A. F. C.—D. D.—E.—G. E. D.—G. H.—G. J.—H. R. J.—J. B. Jr.—J. H.—M.—M.—M. H. J.—N. B. C.—N. D.—S. B. F.—S. S.—T. A. R.—T. C.—W. P. M.
QUERIES.—E. B.—G. C.—G. P.—T. B.—S. L. J.

Inventions Patented in England by Americans.

From October 17 to October 23, 1871, inclusive.
(Compiled from the Commissioners of Patents' Journal.)
AUGERS, ETC.—J. Swan, New Haven, Conn.
BATTERY.—L. Bastet, H. Selligman, Tarrytown, N. Y.
COUPLING.—W. Washburn, Brooklyn, N. Y.
INKSTAND, ETC.—S. C. Catlin, Cleveland, Ohio.
LIQUID METER.—T. A. Curtis, Springfield, Mass.
LOOM.—J. Short, New York city.
PENCIL, ETC.—J. Reckendorfer, New York city.
PREFRIGER.—E. Duffee, Haverhill, Mass.
STEAM PUMP, ETC.—W. E. Prall, Washington, D. C.

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.—CALCINATION OF CHALK.—Will some of your readers oblige a Havana correspondent with a description of the process of calcination, pulverization, and sifting of sulphate of lime (chalk) and also give a description of the apparatus used? Are the kilns reverberatory furnaces or open air constructions? What would the appliances, for turning out two or three hundred barrels of chalk a day, cost?—S. G.

2.—PREVENTION OF RUST.—What can I coat my smoke-stack with to prevent its rusting? I have used red lead and oil, but it did but little good.—L. X. W.

3.—CASE HARDENING.—Will some kind reader favor me with the process, in detail, for case hardening finished set screws, nuts, etc? Is there any way of hardening a large lot of the above at one time, by a bath, solution, or any other mode available in such a case?—E. N. G.

4.—FILTER IN CISTERN.—What is the best method of constructing a filter to a cistern? What porous material is best to be used as a bottom to such a filter, that is, to support the charcoal, gravel and sand?—H. B. M.

5.—MITER OF HOPPER.—Will some one give me a brief yet scientific rule for laying out the miter of a hopper?—N. B. B.

6.—SETTING SAW.—Can some one tell me how to file and set a small circular saw, so as to cut very smoothly, and be used equally well for splitting and cross-cut sawing?—J. H. M.

7.—CANKER IN THE MOUTH.—I would like to enquire if any of your correspondents can tell me how to cure canker in the mouth? I have tried alum, borax, goldthread, tannin, sulphate of copper, nitrate of silver, colts' foot, carbolic acid and homoeopathic doses of *hydrastis canadensis*; but none of these do any good. I am willing to try anything that is recommended in good faith. For six weeks I used no drink excepting a decoction of red clover tops, but all to no purpose.—F. S. C.

8.—PREVENTION OF FERMENTATION.—Will some one tell me how to keep new cider from fermenting, without doctoring it with chemicals of any kind? Can I do it by keeping it at a temperature nearly down to the freezing point? And should it be barrelled tight from the air?—F. S. C.

9.—EXPANSION OF BELT.—A. and B. have got into a dispute. A. says a belt is tighter in wet weather than in dry; B. says it is tighter in dry weather. Will some one please say which is right?—G. W. F.

10.—BRAZING FOR STEEL.—What is the strongest and best steel brazing, and what flux is used?—M. B. H.

11.—PREVENTION OF SCALE IN BOILER.—What is the best article used to keep steam boilers from scaling? I have tried a great many things, but to no effect. The water used is mostly from a well in a limestone rock. My boiler is tubular, for a ten horse engine. It has scaled considerably already. Any information in regard to this matter will be thankfully received. Is tannate of soda a good article for the purpose? If so, how much should be used at a time, and how often?—C. M.

12.—PREVENTING INCORUSTATION IN BOILER.—I notice in a late number of SCIENTIFIC AMERICAN, an article recommending the use of tannate of soda to prevent incrustation in boilers, etc. Can any one tell me the quantity required per horse power, and where the article can be obtained?—S. P.

13.—CEMENT FOR AMBER.—Will some one please give me a receipt for a cement to mend amber?—J. R.

14.—BRONZING ORNAMENTS.—What is the simplest method for re-bronzing ornaments?—J. R.

15.—FINISHING CROSS HEADS AND PINS.—Will some of your correspondents give me information of a machine for, or any good method of, dressing off and finishing cross head pins or wrist pins, the cross head and pin being cast in one piece, similar to locomotive cross heads? The pin, when done, must be true and square, and, in fact, superior to hand work. I want to finish a good range of sizes, say for from 5 to 50 horse power engines.—W.

16.—BLASTING UNDER WATER.—I have some 6,000 yards of rock to remove under twelve feet of water; average depth of rock to be taken out, about two feet. Can any one, who has had practical experience in removing rock under water, inform me if dynamite would act effectually in such a situation; and what would the probable cost per yard be?—F. A. W.

17.—WEAR OF VALVE SEAT.—Why does a valve seat wear concave where a valve travels over the whole seat every semi-revolution of the eccentric?—W. C.

18.—INCREASING POWER.—Having a rather limited steam power, to drive a thirty inch circular saw, I wish to be informed by some reader of the SCIENTIFIC AMERICAN if it will increase the power of the saw to attach a fly wheel, say thirty-six inches diameter, with a narrow round rim, weighing about seventy-five pounds, to the saw shaft, on the opposite end from the saw.—E. K.

19.—DYE FROM POKE BERRIES.—Can any one of your readers tell me how to make the coloring of poke berries (*phytolacca decandra*) permanent enough for carpeting?—E. E. S.

20.—PREVENTION OF RUST.—Can any of your readers inform me by what means rust can be prevented on screwed iron articles? I use a solution of soap water and oil in screwing, and wash with soap water heated. Will keeping said articles in a basement (though a dry one) cause the rust?—I. K. F.

21.—WHITENESS FOR OUT DOOR USE.—I want a wash, white or nearly so, for lime stucco, outside, that will not crack, peel, or wash off, and will make the walls impervious to water.—W. T. S.

22.—PURIFYING KEROSENE OIL.—Is there any method, by which kerosene oil, which has been used for removing whale oil and grease from different articles, and is very black and dirty from the foreign elements held in solution, may be redeemed for illuminating purposes, either by filtering, or other process? We daily destroy many gallons in this use, which, if it could be reclaimed, would be a great saving. Soda and potash for cleaning are not as preferable to us as kerosene. Benzine is too dangerous; and therefore if some of your readers will "post" us, we shall feel indebted for the favor.—N. L. & Co.

23.—FORM OF PUNCH FOR CUTTING METALS.—What is the best punch to use in punching machines, for punching metals, like boiler plate? Should the punch be straight, or taper, and if made to taper, which way?—A. M. S.

24.—BLACK COLOR ON BRASS WORK.—Will some one of the many readers of the SCIENTIFIC AMERICAN inform me how the black color on brass work, for optical instruments, is produced?—C. D.

APPLICATIONS FOR EXTENSION OF PATENTS.

STRAW CUTTER.—David H. Mumma, Harrisburgh, Pa., administrator of Jacob H. Mumma, deceased, has petitioned for an extension of the above patent. Day of hearing, January 10, 1872.

CARPET BEATING MACHINE.—Joseph Harris, Jr., Boston, Mass., and Daniel Holmes, New York city, have petitioned for an extension of the above patent. Day of hearing, February 7, 1872.

FLASKS FOR CASTING WHEELS.—Frederick Nishwitz, Belvidere, N. J., has petitioned for an extension of the above patent. Day of hearing, Jan. 7, 1872.

Recent American and Foreign Patents.

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

UMBRELLAS AND PARASOLS.—The ribs and braces of parasols and umbrellas are joined with balls, playing in suitable sockets. The sleeve is perforated and provided with enlargements to constitute sockets for the ball joints. The slide is made in a similar manner, and combined with a movable ring to confine the balls in the enlargement, the combination being made in a peculiar manner. The ribs are provided with double winged spherical clasps to receive the balls on the ends of the braces. This construction greatly facilitates the removal of the ribs and braces, and gives free play at the joints. Walter Watson of Fayetteville, N. C., is the inventor.

STOP COCK.—This is the invention of Hermann Muller, of Vienna, Austria, assignor to Francis Telbinger, of the same place. The patent is granted on five distinct claims, and the nature of the invention forbids anything more than a mere general outline in this place. The valves are conical, and are opened and closed by a system of worm gearing, actuated by a hand wheel a dial being employed to indicate the extent to which the valve is opened. The valve is a two part valve, consisting of two truncated cones, which are simultaneously actuated by a right and left threaded screw of uniform pitch.

SELF OPERATING GATE.—This invention is a combination of bell cranks, cranks and rods, and also a combination of hinges and guides in connection with the bell cranks, cranks and rods, to facilitate the opening and closing of arm gates, so that, either of the cranks being depressed by the wheel of an approaching carriage, the gate will be slid up on its hinges, and, being thereby unlatched and eanted, will automatically swing open and so remain until a corresponding crank on the other side is depressed, which reverses the operation and closes the gate. William H. Phillips, of Staunton, Ind., is the inventor.

VALVES FOR STEAMBOAT ENGINES.—Andrew M. Halley, of Sioux City, Iowa.—A steam supply pipe and exhaust pipe, combined with a chamber, communicate with the steam cylinder. An open ended tube is made movable through the chamber, one end of which may be lowered upon a seat, to constitute a valve to prevent the escape of steam from the steam cylinder to the exhaust pipe, or raised to open the exhaust. A circular valve is suspended from a rod and made to fit the lower end of the movable tube. When the tubular valve is raised to open the exhaust, the circular valve is also elevated. When the hollow valve is lowered to close the exhaust, the circular valve is also lowered to permit the entrance of steam to the cylinder, the tubular valve reaching its seat first in the latter operation, and being closed by the cylindrical valve before raising in exhausting. By the proper adjustment of parts, the steam may be cut off at any part of the stroke, and the exhaust closure controlled. By the use of this simple valve the exhaust chamber is done away with, as are also other parts necessary to the operation of other valves, while, in point of economy, we see no reason why excellent results should not be obtained.

COMBINED BURGLAR AND FIRE ALARM.—Louis Glebrich, of Ottumwa, Iowa.—This invention relates to a new apparatus for sounding an alarm in case fire breaks out in any part of a building within which it is set up. The apparatus may also be connected with a burglar alarm, if desired. The invention consists in a new arrangement of alarm setting; also, in a novel alarm discharging apparatus, as well as in further combinations and novel arrangements of parts, whereby, whenever, in any part of the building, fire breaks out, a fuse will be speedily ignited, and will rapidly burn toward a case, where it reaches powder, causing the same to explode and to separate the parts of a cylinder, and also a cord, releasing one of several levers which swings a shaft to disengage a cord, swing a lever, rotate a shaft, vibrate bells, and also discharge a cannon. Thorough alarm is thus immediately sounded.

CLOTH STRIP BRISTLES.—Arthur P. Peyroux, New Orleans, La.—This invention has for its object to furnish improved cloth strip bristles, designed for use in repairing all kinds of cotton gins that can be repaired with strip bristles. The cloth strip bristles are made of two bands or strips of linen or cotton buckram, or other suitable cloth. The strips of cloth are about three quarters of an inch wide, and about thirty inches long. The strips are furnished or trimmed with boars' bristles of various qualities and prices, and are covered or coated with a gum or paste made of water, good cabinet glue, Spanish whiting, and marble dust or powder, and heated to the required consistency. The bristles are then spread over the strips, by hand, with a tool or implement. The cloth strip bristles thus prepared are placed under a screw or other press, to make them of equal and uniform thickness, and to fasten the strips and bristles well together. The cloth strip bristles thus prepared are not affected by water, moisture, dampness, or heat, and will remain sound and perfect under long continued use.

STOP VALVE.—Fred. D. Livingston, Norwich, Conn.—The inventor proposes to arrange the dividing plate within the shell with two parts parallel with each other, one on each of two opposite sides of the axis of the connections, and as far apart as the diameter of the said connection, or thereabout, and to make a valve seat in each with their axes coinciding with the opening through the shell for applying the valves, the lower seat being the smallest, and the upper one large enough to pass the valve for the lower one through it. For these two seats he makes a double valve fitting both and connected by a tube, having an internal screw thread, in which a screw threaded stem works to raise and lower the valves, the said stem passing through a screw plug and down to an adjustable step in the lower side of the shell, on which it rests. The plug has a valve seat at the lower side surrounding the hole for the stem, and the latter has a conical valve fitting it, and held up against it by a screw, to be used for preventing the escape of steam instead of the packing commonly used. The valves are prevented from turning with the stem by the friction of a pin rising up into a hole in the plug. By the employment of the two plates and the two valves, a freer passage within the shell is given than can be done by the ordinary arrangement. This improved valve is well adapted for connecting to a governor for use as a throttle valve for regulating the speed of an engine.

GAS REGULATOR.—John Keeling, New York city.—The object of this invention is to furnish an improved means for regulating or equalizing the pressure of illuminating gas in the pipes through which it is conducted to dwellings. It consists in the combination of an automatically variable counterpoise with the bell of a gas governor, with which the service pipe is connected. The counterpoise is formed of two vessels partly filled with water, provided with air cocks, and connected by a flexible tube, through which the water may flow from one to the other according as the bell rises and falls. The use of a water counterpoise is described in a patent granted to the same inventor in England, in December, 1864. No cocks were, however, provided for passage of air from and into each vessel. Hence that invention was so far inoperative as to be practically useless, the flow of water from one vessel to the other being merely the almost inappreciable quantity necessary to fill whatever space might be formed by compression and expansion of the air in the vessels respectively. In this invention one of the vessels is connected with the same walking beam as the gasometer bell, and the other with the spindle of a dial hand or index. There being a spring connected with said spindle, the support of the counterpoise will yield to suit the varying changes in the amount of water in the respective vessels.

BURGLAR ALARM.—Robert William Newbery, New York city.—This invention relates to the application of a detonating cracker to doors and windows, drawers, and other movable devices, for the purpose of serving as a burglar alarm. The detonating cracker consists of a cartridge and two strips which overlap each other within the cartridge and extend from the ends thereof. The explosive matter is placed within the cartridge between or otherwise in contact with the overlapping strips, so that when the strips are pulled they will, by friction, cause the firing of the charge and consequent explosion. A shield is fastened against the back of the cartridge. Its object is to protect the paint of the door, window, or other article to which the alarm is applied, and prevent its being defaced or injured by the explosion. The strips and cartridge should be made of incombustible material, so that the shreds, after explosion, will not set any thing on fire, burn holes into carpets, or do other damage to property. The ends of the strips are, by tacks, pins, or gum, fastened in place, so that the opening, by unauthorized persons, of a door, window, lid, or drawer, will cause the explosion and alarm.

ROTARY ENGINE.—John W. Barriger, of Omaha, Neb.—We cannot very fully describe this engine further than to say that it belongs to that class in which a rotary cylinder, provided with adjustable sliding pistons, is arranged in a cylindrical case, the pistons being controlled in their position and motion by cam grooves, four ports for the admission of steam being employed. There are peculiarities of construction which are novel, and which are covered by the following claims: first, a cam provided with abutments and combined with the rotating cylinder, sliding pistons, and with heads which have the cam grooves and four pairs of ports; second, sliding pistons provided with projecting tenons and with shallow steam grooves.

APPARATUS FOR EXHIBITING CARDS, ETC.—Isaac M. Miller, of Huntville, Ala.—This is an improvement in card cases and apparatus for presenting the cards, contained in a case before a glass for being exhibited, and moving them away again. It consists in a pair of endless belts, arranged to run together from the under or discharging side of a cylinder to the upper or receiving side, and to receive the cards between them from the cylinder and convey them to the space above; the cylinder, in connection with which said belts are used, being arranged in front of a concavo-convex glass front and, with suitable operating gear, to cause the cards to pass in succession before the glass.

WATER GRATE FOR STEAM BOILERS.—Thomas Stone, of Carbondale, Ill.—This invention relates to a mode of constructing water grates for steam boilers and arranging and connecting them with the boiler, whereby the steam generating or fire surface is greatly increased and the grate rendered durable. The force pump is attached to one end of the mud pipe, so that the feed water is forced up through each of the grate bars through a pipe into the boiler. A stop cock cuts off communication between the grate and the boiler whenever it may be necessary to do so; as, for instance, when it may be desired to discharge the water contained in the grate and retain the water in the boiler. It is designed to make the grate bars of wrought iron, bent to the required curve. The water grate bar joined in this manner will not be injured by expansion and contraction or the effect of heat and cold. The bars, being always supplied with water, are kept so cool that clinkers will not adhere to them, and as they furnish a large increase of fire surface, the power of the boiler is correspondingly increased and fuel economized.

WRENCH.—Thomas D. McElride, of Philadelphia, Pa.—This is an improved wrench, so constructed that it may be adjusted in different positions to adapt it for turning nuts or bolts in different positions or in any position. Upon one side of the head of the wrench are formed jaws to grasp the nut or bolt head. The opposite end or part of the head is made rectangular in form, and has holes formed in it to receive the end of the handle. One hole is formed in the end of the head in line with the jaws. Another hole is formed in the side of the head, at right angles with the plane of the jaws and in the same plane. The handle is made with a set or bend near one end, so that it may be used as a straight or S-handle, as may be desired. The holes for the reception of the handle are made slightly tapering, as are also the ends of the handle, so that it may be tapped firmly into said holes. The head and handle are designed to be both cast so as to require no fitting, thus enabling the wrench to be made at small expense. This construction enables the wrench to be easily and conveniently adjusted to take hold of the nut or bolt head, whatever may be its position.

CULTIVATOR.—Julius W. Hatcher, of Bethesda, Tenn.—This invention relates to an improvement, in the class of cotton cultivating machines in which a vibrating blade is employed to thin or cut out the cotton in the row at suitable intervals of space. The improvement consists in the arrangement of a rotating cam wheel of suitable construction, vibrating cutter, and directly connected parts, whereby, it is claimed, a lighter, cheaper, and more easily managed machine is produced than those heretofore known or used.

WHEELBARROW.—John Gehr, Clear Spring, Md.—This invention relates to a wheelbarrow, in which the axle of the wheel is mounted in goosenecks attached to the front end of the barrow and projecting upwards therefrom, thus enabling a large wheel to be employed with a low barrow; also to the combination of the axle with the barrow by means of springs and guards.

APPARATUS FOR REEFING SAILS.—John E. Worthman, Mobile, Ala.—This invention has for its object to enable either square or fore and aft sails to be reefed singly, doubly, or to any required extent, through the medium of apparatus operated from the deck by means of halliards, without requiring a single man to go aloft or to lay out upon a boom, and without necessitating the heaving-to of the vessel or the changing of her course in any respect.

EGG CARRIER.—Christopher Tennant, Dublin, Md.—This invention relates to a box closely filled with superimposed plates of cork or other woody or otherwise constituted substance, the same having parallel rows of holes made transversely through them to receive eggs standing on end in hollows, which in any one plate are directly over the holes of the plate next beneath it, and the holes of any one plate are directly above the hollows of the plate next beneath it.

BEER OR SPIRIT PACKAGE REVENUE STAMP PROTECTOR.—Robert M. Smith, Baltimore, Md.—This is a contrivance for the protection of revenue stamps upon beer or spirit packages against injury by the gnawing of animals or exposure to the weather, while at the same time it allows them to be readily inspected.

LUBRICATING CAR WHEELS.—Cyrus Smith, of Irwin's Station, Pa.—This invention relates to improvements for lubricating the axles of coal cars and all other vehicles whose wheels turn loose on their axles, and has for its object to provide for a proper lubrication of the hubs and retention of the oil, and to prevent dust and dirt from entering the hub and wearing the axle. Three oil cups, provided with the oil vessels, perforated plates or pieces, covers, and screws, are applied to the sides of the wheel hub, and a combination of an adjustable wedge shaped clevis and screw, with a lead ring and collar, is used to close the back of the hub, and take up the wear of the packing.

APPARATUS FOR LIGHTING GAS BY ELECTRICITY.—John Vansant, of San Francisco, Cal.—This invention comprises a combination, with a single fixed coil, of two tubular magnets, one fixed and the other movable, as set forth; also a combination of two magnets with a single helix; also a cap made larger in cross section than the empty space around and within it, for effecting an increased motion and pressure of the mercury which is used to prevent escape of gas. Radiating coils of bad heat conducting wire, supported by pins on an insulating pipe, are used; also an insulated spring, connected with one end of the helix wire, and so arranged as to effect a ground connection when required, the whole being intended to furnish a simple means of lighting gas by electricity.

BALING PRESS.—Justin D. Townner and General J. Harris, of Murfreesborough, Tenn.—This improvement in presses for hay, cotton, and the like, consists in a novel arrangement of a capstan, rope, and pulleys for working the follower by horse power, the said arrangement, it is claimed, being very simple and cheap. To effect this a combination, with the press case and follower, of ropes, pulleys, and a capstan is used, and also a combination, with the follower, of the ropes, pulleys, a roller, and a hand crank, arranged in a peculiar manner relatively to the press case and the horse power apparatus.

SALVE FOR THE CURE OF RHEUMATISM.—Joseph Mickel, of East Birmingham, Pa.—This is a compound for the treatment of rheumatism composed of various vegetable and animal ingredients of recognized efficacy in the treatment of this tormenting and dangerous complaint.

IMPROVED GATE.—William A. Penney, Morrisville, Wake Co., N. C., patented November 7th, 1871.—This invention relates to a gate having a groove in the under side of its upper rail into which extends a vertical pin, springing from an arm extending from one gate post, which pin guides the gate as it runs backward or forward; the gate being provided with an apparatus for automatically turning it, when half opened, to a position at right angles with that which it occupies when closed, and for fastening it in this position. A novel device is also provided for locking the gate when closed.

PLow.—Thomas Cumling, Jr., of Brookhaven, Mississippi.—This invention consists in a combination with the mold board and landside of a turn-plow, and of an adjustable share arranged between them.

DYER.—Alfred W. J. Mason, of New Orleans, Louisiana.—This invention consists of separate heating or drying chambers with two endless belts of wire gauze or other open substance, through which the air can circulate freely, passing through said chambers to carry the substance to be dried between them; the said belts being arranged one above another to receive the said substances between them. Streams of cold or heated air (or gases for bleaching) are forced into each chamber, which has its own separate discharge pipe, so that the aqueous vapor expelled from the wet substances in the first chambers will not enter those through which they pass during the latter part of the operation. The air is delivered upon the belts from contrary directions to get the best effects, and graduated in temperature according to the nature of the case, and the belts are moved fast or slow, as required. The said improved apparatus is applicable for drying damp or wet cotton, wool, cloths, and other substances.

ROTARY STEAM VALVE AND CUT OFF.—Hugh Wright, of Warren, Ohio.—The object of this invention is to furnish a simple and convenient valve movement for steam engines, with a cut off, which shall vary the quantity of steam admitted to the cylinder, according to the amount of work which the engine has to do; and it consists in connecting the valve apparatus and steam chamber with the head of the cylinder and operating the valves in a peculiar manner, which cannot be explained in such a notice as this.

GATE.—Robert J. Wood, of Hancock, Michigan.—This invention relates to improvements in apparatus for opening and closing gates, to be set in motion by persons in a carriage or on horseback on approaching the gate to pass through; and it consists in a circular plate or track mounted on a pivot under the gate for tilting, for lifting the gate when either closed or open, and causing it to swing by rolling down the said track, on which it rests by a friction roller, and apparatus for tilting said plate.

ALCOHOL STILL.—Anderson Booz, Buchanan, Botetourt Co., Va., Patented November 7th, 1871.—This invention relates to a cap for a still, said cap receiving the vapor from the steamed mass in the still, and conducting such vapor through a coil of pipe wherein it is condensed and from which it flows in the condition of singlings to the low wine room; said cap also receiving through a pump singlings from the low wine room, and vaporizing them by means of the heat of the aforesaid coil, which vapor is discharged through a separate pipe in the form of alcohol, the residuum or feints from the heated singlings being drawn off from the cap through a tube at its lower end.

WOOD PLANING MACHINE.—Newton C. Freck and Solomon Strock, of Millersburg, Pennsylvania.—This invention consists in the application to planing machines of feed rollers, edging tools, and guides adapted for feeding and working two or more boards, side by side, simultaneously, planing them on the side and both edges. The feed rollers are provided with two or more fluted sections between the cylindrical parts, according to whether two or more boards are to be planed at once; and it has one center cutter head, and two others, for dressing the edges when two boards are to be run at once. If three are to be run, there will be four of these cutters; but only three are used for two boards at once. In this case the center head will be non-adjustable, and a guide, as wide as said head, will be arranged with it for the two boards to be pressed up to by spring guides or rollers at their outer edges, and the outer heads will be adjustable toward and from said center head, as the width of the boards varies. If four cutter heads are to be used, three of them will be adjustable, or two may be non-adjustable, as preferred. A screw rod is employed for adjusting the outer cutter heads, the connections of it with them or the bearings in which they run being of any approved arrangement. By preference the center head will carry the grooving tools when the stuff is being dressed for flooring, and the outer ones will have the tonguing tools.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING NOVEMBER 8, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES:	
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On each Trade-Mark	\$10
On filing each application for a Patent, (seventeen years)	\$15
On issuing each original Patent	\$20
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- 120,564.—CLEANING WASTE.—H. M. Baker, Brooklyn, N. Y.
 120,565.—PISTON PACKING.—G. F. Blake, Boston, Mass.
 120,566.—TONGS.—J. Bradbury, Berlin, Conn.
 120,567.—TONGS.—J. Bradbury, Berlin, Conn.
 120,568.—CASTER.—J. Bradbury, Berlin, Conn.
 120,569.—BIRD CAGE HOOK.—J. Bradbury, Berlin, Conn.
 120,570.—CLOTHES HOLDER.—W. Z. Brown, Decatur, Ill.
 120,571.—FENDER.—G. Buchanan, Washington, Pa.
 120,572.—PLOW.—L. Chapman, Collinsville, Conn.
 120,573.—GATE.—D. Creighton, Vacaville, Cal.
 120,574.—TORPEDO.—J. C. Dickey, Titusville, Pa.
 120,575.—BOTTLE.—L. P. Dodge, New York city.
 120,577.—BOLT FOR SAILS.—J. Farrel, New York city.
 120,578.—LETTER BOX.—J. A. Farrington, Brooklyn, N. Y.
 120,579.—COMPOSITION.—W. A. Fischer, Allegheny City, Pa.
 120,580.—HINGE.—R. B. Fouzer, Butler, Pa.
 120,581.—PLOW WHEEL.—H. Galentine, Greece, N. Y.
 120,582.—GRAIN SEPARATOR.—C. S. Hall, Rochester, N. Y.
 120,583.—SUSPENDER.—M. Harris, New York city.
 120,584.—SUSPENDER, ETC.—M. Harris, New York city.
 120,585.—DRYER, ETC.—J. H. Hiron, Buchanan, Mich.
 120,586.—PISTON.—O. S. Howard, Bangor, Me.
 120,587.—BED BOTTOM.—C. Johnson, Chicago, Ill.
 120,588.—MACHINE GUN.—G. O. Kline, Hartford, Conn.
 120,589.—PLAHER.—H. A. Lee, Worcester, Mass.
 120,590.—GAS APPARATUS.—G. Lowden, Brooklyn, N. Y.
 120,591.—FLUTING MACHINE.—J. W. Madden, Buffalo, N. Y.
 120,592.—RAILWAY SWITCH.—E. Mercier, Springfield, Mass.
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 120,595.—INSECT TRAP.—C. E. Penny, Fort Wayne, Ind.
 120,596.—EXTRACTING OILS.—G. G. Percival, Waterville, Me.
 120,597.—AIR COMPRESSOR.—W. E. Prall, Washington, D. C.
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 120,601.—BREASTPIN.—D. O. Stanley, South Attleborough, Mass.
 120,602.—HARVESTER.—O. Webster, Murray, N. Y.

120,603.—BRAKE.—A. Wellshmidt, Albany, N. Y.
 120,604.—DESK, ETC.—A. Wibbert, Milwaukee, Wis.
 120,605.—COMPOSITION.—H. K. Wilson, Barboursville, Ky.
 120,606.—TANNING HIDES.—H. P. Wilson, New York city.
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 120,619.—CHAIN LOCK.—L. F. Cahn, New York city.
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 120,802.—STOVE.—J. W. O. Webb, Vinton, Iowa.
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 120,804.—DUMPING WAGON.—J. I. Wolf, Greenfield, Ohio.
 120,805.—REEPING SAWS.—J. E. Worthman, Mobile, Ala.
 120,806.—CRUCIBLE.—R. Yelding, Detroit, Mich.
 120,807.—CORSET.—S. Young, Elmira, N. Y.

RE-ISSUES.

4,621.—CARRIAGE TOP.—S. L. Barnett and Simon Beery, Urbana, Ohio. Patent No. 52,126, dated January 23, 1866.
 4,622.—IRON AND STEEL.—J. Jameson, Phila., Pa.—Patent No. 92,054, dated June 29, 1869.
 4,623.—MOTIVE POWER.—R. T. Smith, Nashua, N. H.—Patent No. 99,099, dated October 23, 1866.
 4,624.—ROOFING.—J. H. Smyser, Pittsburgh, Pa.—Patent No. 113,588, dated April 11, 1871.
 4,625.—HEAD BLOCK.—E. H. Stearns, Erie, Pa.—Patent No. 81,857, dated September 1, 1868.
 4,626.—FLOUR PACKER.—S. Taggart, Indianapolis, Ind.—Patent No. 24,963, dated August 2, 1859.
 4,627.—LAMP HEATER.—W. N. White, Winchendon, Mass.—Patent No. 108,863, dated November 1, 1870.
 4,628.—CAN, ETC.—J. K. Chase, New York City.—Patent No. 101,430, dated April 5, 1870.
 4,629.—HARVESTER.—J. H. Keller, Boalsburg, Pa.—Patent No. 109,912, dated November 1, 1870.
 4,630.—OIL.—T. Richardson, J. J. Lundy, and R. Irvine, London, England.—Patent No. 42,987, dated May 31, 1864.
 4,631.—WAGON.—J. L. Stropes, Bloomfield, Ind.—Patent No. 117,014, dated July 11, 1871.
 4,632.—MAGNETIC ENGINE.—J. P. Tirrell, Charlestown, Mass.—Patent No. 118,561, dated August 29, 1871.
 4,633.—GLOBE.—T. Trudeau, Ottawa, Canada.—Patent No. 117,086, dated July 25, 1871.

DESIGNS.

5,348.—TONGS.—J. A. Ervien, Phila., Pa.
 5,349.—STOVE.—R. Scorer, R. Ham, Troy, N. Y.
 5,350.—Not issued.
 5,351.—FIRE DOG.—A. Wunder, New Haven, Conn.
 5,352.—CARPETS.—A. Cowell, Kidderminster, Eng.
 5,353.—CARPET.—V. Guérille, Glasgow, Scotland.
 5,354.—CARPETS.—J. M. Silcox, Kidderminster, Eng.

TRADE MARKS.

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 518.—CHUCKS.—E. Horton & Son, Windsor Locks, Conn.
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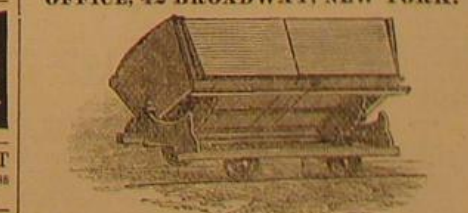
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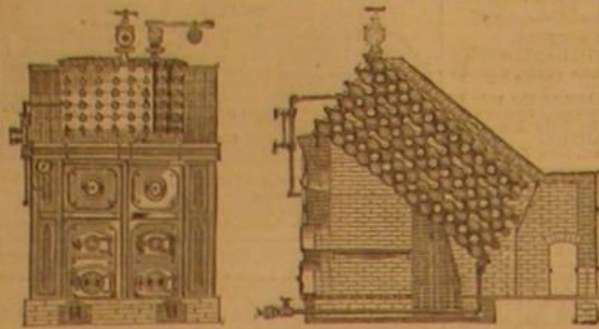
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(IN ADVANCE.)

The Screw Mower and Reaper.

A new mechanical movement, as a possible element of future machines, always possesses a peculiar interest. This interest is greatly heightened when, as in the present instance, such a movement has been demonstrated to be of real practical value. The peculiar feature, of the mower and reaper shown in our engravings, is the application of a worm wheel and screw to the rotation of the crank shaft which drives the cutter bar, which worm wheel and screw possess features that entitle the arrangement to be classed as a new movement. Fig. 1 is a perspective view, the parts of the machine being lettered as follows: A is the worm gear wheel, B the screw, C the step pin, D the casing of the worm gear, a portion being broken away, E the connecting rod wheel, F the connecting rod, G the cutter bar, and H the draft rod.

The latter is so attached that the draft is applied to the rear of the axle in such a way as to throw nearly the whole weight of the machine on to the axle, and thence on to the driving and carrying wheels. Side draft is balanced by making the outside drive wheel slightly smaller than the inside, thus throwing more labor on the former. In regard to the worm wheel, it will be seen, on reference to Fig. 2, that it is peculiarly constructed, the teeth being formed very differently from those of the ordinary worm gear, where the screw actuates the wheel. In this case, the wheel impelling the screw, the teeth are so cut that they only operate on that side of the axis of the screw at which they disengage from their contact with the thread.

At first sight this may seem a trifling alteration from the old form, but in effect it so much reduces the friction of this kind of train that we are assured actual test shows a reduction of loss from friction in the application of power, in favor of this train, as compared with the best cut spur gearing. A moment's reflection will serve to convince our mechanical readers that teeth made to act on both sides of the axis of the screw will, at the side on which they enter, really act to consume the power applied at the other side, on account of their coming in contact before they have fully entered the interspaces, and the strong lateral pressure they exert upon the journals of the screw shafts. By the peculiar pitch of the screw thread employed in this movement, and the shape given to the teeth, the two do not come into contact until the teeth reach the position to act with greatest power upon the incline of the thread, and with the least friction.

By this means the end thrust of the screw, received by the step pin, C, is so reduced that, we are told, a nickel five cent piece, placed between the end of the step pin and its bearing in the end of the shaft, did not wear out during a whole season of active work in mowing and reaping, and that no trouble from heating has been experienced.

The screw is of steel, double threaded, and consequently revolves once on the passage of two teeth. The worm gear is of gun metal, which further reduces the friction. The simplicity of the arrangement is apparent, and we are assured the proprietors will at any time test their machine with others to show its superior lightness of draft.

As shown in Fig. 1, the gear is inclosed in an iron case, which forms part of the frame.

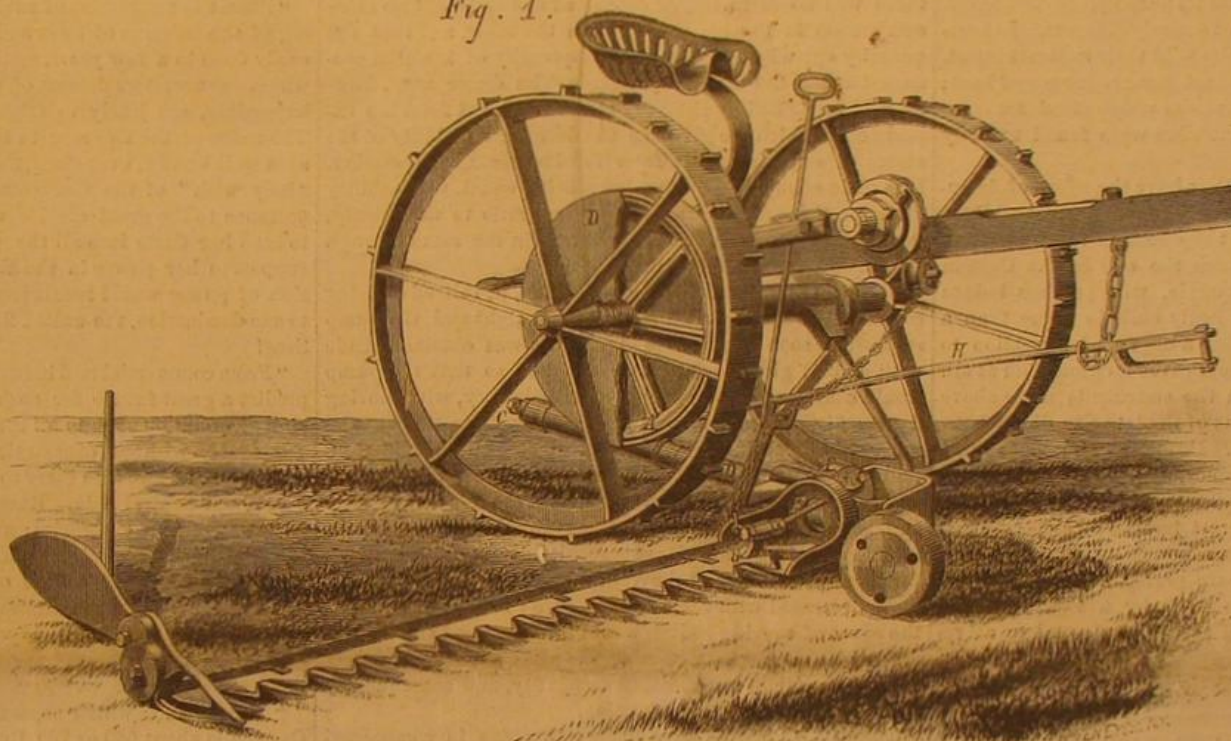
The finger bar, shoe, etc., are attached to or taken from the frame, without bolts or pins, by a hinged coupling, that allows the bar to work below or above a level. The bar can be thrown entirely up by the driver while in his seat, without stopping his machine; the cutting apparatus may be adjusted to any required light or set at any angle, and the main frame to awing under or over the axle, thereby giving a front or rear cut combined, without

disturbing in the least the driving device. The frame may be cast all in one piece, or parts of it made of wrought iron.

On the whole, we incline to regard this an important and valuable improvement, an opinion that is strengthened by reports that reach us in regard to its working during two seasons of actual service.

Three manufactories are now making the machines, and at one, in Wheeling, Va., 1,000 machines are now building. The patent is now owned by the Universal Mower and Reaper Company, 91 Liberty street, New York, who will license the manufacture of the machines, or the application of the screw

Fig. 1.



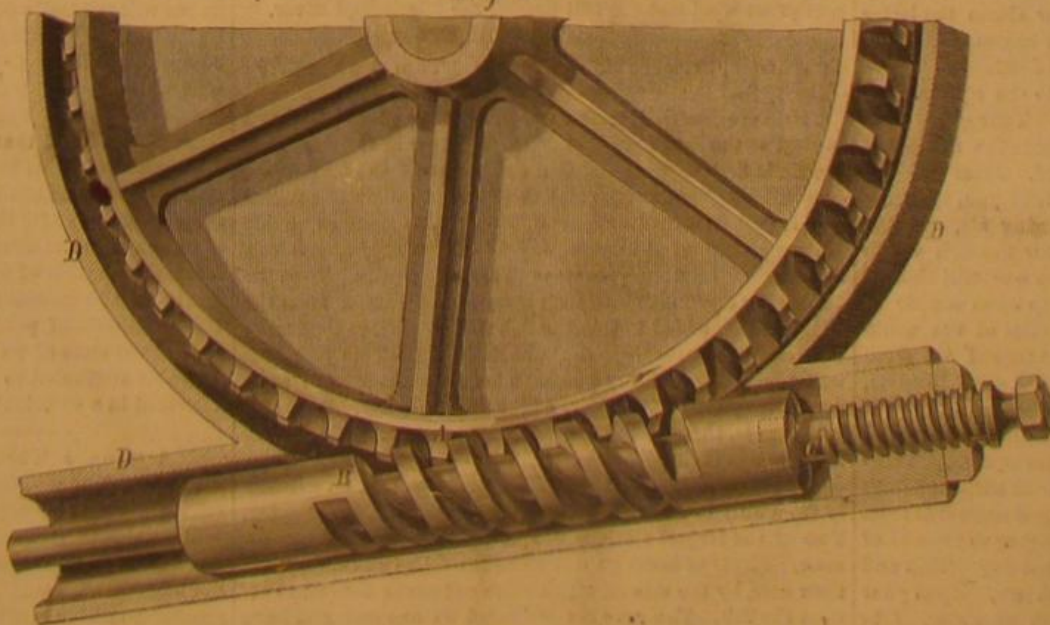
GOODWIN'S SCREW MOWER AND REAPER.

and worm gear attachment, on royalty. The machine was patented by Wm. Farr Goodwin, March 30, 1869, and August 29, 1871.

A Burmese Hairy Woman.

A correspondent of the London Times writes to that journal the following particulars, referring to a hairy woman and her children, of whom he had before spoken in his letters: "When I was at Mandalay in 1859, I saw the same woman and three of her children. The eldest and youngest were hairy like their mother, while the second, like his father, presented no such peculiarity. The husband was a man who report said was induced to wed this woman to become possessed of the marriage portion which the King of Burmah

Fig. 2.



had promised to bestow upon her on her bridal day. The bridegroom was a plucky individual at any rate, though his motives may have been mercenary. The hairy woman, whose name I forget, had a pleasant and intelligent face—there was nothing whatever repulsive in it. The hair on the face and breast was several inches long; on the forehead it was parted in the middle, and blended with that of her head. Of a light

brown color on her cheeks, it paled gradually towards the bridge of her nose, and the centre of her lips, chin, and neck. Those of your readers who have a copy of Colonel Yule's narrative of the embassy to Ava will see a good likeness of the woman, and a description of herself and family."

ROOFS, PAVEMENTS, AND SAFES, UNDER FIRE AT CHICAGO.

The office of the *American Builder*, at Chicago, sharing the common fate of the other periodicals, during the late conflagration was burned down. But the publishers, with commendable enterprise, have reproduced the publication, and the number for November, now before us, contains much interesting matter, from which we take the following:

ROOFS.

"The business blocks of Chicago were covered, chiefly, with paper coated with tar and gravel, a preparation commonly known as felt roofing. Even the 'fireproof' Tribune building was covered with this material, which has been in general use throughout the United States for a number of years. During the progress of the fire it became very evident that these roofs assisted materially in the spread of the conflagration. The heat was, of course, intense where adjacent buildings were in flames, the tar melted, and ignition was the consequence; so that roofs which ordinarily resist fire, in this instance were prime aids in spreading it.

"The *Builder* has always been opposed to the use of this kind of roofing material,

and now we insist upon it that architects and builders abandon it altogether. It may be well enough to use it upon isolated cheap dwellings, but let us have no more of it within the fire limits. Let no architect who values his reputation recommend it to his client. In place of paper and tar, we have tin, iron, or, what is better than either, concrete. This latter will endure fire, and it is not expensive. Our concrete pavements stood intact where great flagging stones flew to pieces. We commend the concrete for roofing purposes, and trust the architects may be induced to listen to reason and experience, and recommend it for all brick and stone edifices.

PAVEMENTS.

"Noticeable among the results of the late fire was the effect upon the different pavements. The Nicholson is, in many places, completely honeycombed, the fire having eaten its way downward into as much of the wood as was dry enough to burn.

"The concrete pavement, which had been laid down in small patches by way of experiment in different parts of the city, endured the test well, and is today in as good condition, apparently, as before the fire. So that, as regards one quality at least, there is little chance for comparison between the wooden and concrete pavements, so great is the advantage in favor of the latter. And there occurs no convincing reason why the concrete should not be more generally adopted. In the instances where it has been employed, the results seem to have been very satisfactory. The wear of heavy vehicles has produced little impression wherever the concrete has been properly laid, and the surface presented is even and well adapted to the transportation of heavy loads. Appearances certainly indicate that,

and durability, the concrete is the pavement for the future. We have not the figures indicating the relative first cost of the different pavements, though the concrete is certainly expensive; but, unless a greater difference exists than appears likely, it would seem that economy and a regard for the public good demand a substitution of the concrete for the wooden surface of our streets.

SAVES AND VAULTS.

"The experience of the late fire affords much information regarding the relative merits of safes and vaults for the preservation of papers or other valuables. The work of digging out safes from the ruins, which was begun as soon as the heat of the smouldering piles would admit, resulted in proving the fact that safes, however well constructed, would not, under all circumstances, preserve their contents unharmed. Those placed in wooden buildings, as a rule, held papers and books in good condition; the materials of which such buildings were composed burned so quickly and entirely, leaving nothing remaining to smoulder and retain the fire, that safes did not become heated through. But in buildings of brick and stone, the result was more unfortunate. The safes fell among masses of material which burned steadily and gave forth intense heat for days after the first fire, and thwarted any attempts made at removal. The safes lying in the midst of such heaps of fire became intensely heated throughout, and when efforts to remove and open them were finally successful, their contents were found in many cases to be ruined. Books, papers, and bank notes still retained their form, but had changed to black in color, and, upon the slightest touch, crumbled into powder. In almost an exact proportion to the length of time they had been forced to remain in the burning ruins, safes were found to have preserved their contents uninjured or partially or totally destroyed. It is evident that, while a well constructed safe will hold, uninjured, books and papers, for a time, yet, if remaining in the fire for a long period, no one yet made will fulfil its purpose.

"With vaults the result proved entirely different. In nearly every instance well built vaults held their contents intact. Bricks and mortar proved excellent non-conductors of heat; and upon the opening of large vaults which stood for some days in the midst of fire, their interiors were found scarcely warm.

"These discoveries will doubtless have the effect of introducing more largely the construction of vaults in buildings devoted to business uses; and the disasters resulting from their faulty construction, of which the one in the Custom House furnished a notable example, will perhaps induce more care in building. A vault badly built is worse than a poor safe, for the latter does afford a degree of protection to what is within it, while the former gives no protection at all.

It must not be inferred from the statements made above that the safes buried in the ruins of the late fire did not accomplish a great degree of good. Property of immense value was preserved through their agency, and, where not exposed to heat of the most intense character and for a long time, the safes generally stood the severest test well, and reflected credit on the makers, and must continue to be used, even where vaults exist; for, to secure perfect safety, valuables must be placed in a safe surrounded by a vault; and, for ordinary fires, safes have proved themselves equal to all requirements. But for such occasions as the late fire, only vaults can afford the perfect security needed."

DOWN IN THE CAISSON OF THE EAST PIER OF THE ST. LOUIS BRIDGE.

(From the Railroad Gazette.)

The grand entrance is a brick shaft dropping vertically to the iron girders, and thence is finished in iron through the air chamber. The steps descend spirally; you find yourself hemmed in by the circular walls of the well. On each side of you are iron doors, about 18 inches square and 30 inches from the floor. The place is damper than a parlor, but drier than a well 60 feet below water surface should be. This you notice while a man who is sweeping the floor tells you that one of the doors will be open in a moment. There is a sound as of a whistling of air through pipes, and soon a door does open, and a man within beckons you to step through, which you do, into an iron bandbox, say 6 feet in diameter and about 9 feet high, containing several pipes with air cocks upon them, and a seat. As your companion has a candle, you observe another similar iron door opposite to the one by which you entered. Your companion now closes the latter and turns one of the cocks, when there comes in, with a sharp, loud hiss, an atmosphere which is destined to arrive at a normal pressure of about 40 pounds to the square inch. Directly you feel a severe pain in one ear. Your guide asks you concerning it, and directs you to perform the motion of swallowing, which you do and are relieved. After this you swallow involuntarily. The guide now tells you, speaking in a key above the hissing of the entering air, that the strength of 40 men could not open the door through which you have just passed, and that the opposite one will shortly be loosened. Soon this occurs, and you slip upon a floor of loose sand, which, illuminated by the candles of the workmen, looks like bright yellow sugar just turned out fresh from the hogshead. You walk through it with great freedom, and even when passing through one of the log girders, which divide the chamber into three compartments, longitudinal with the pier, by an aperture about 18 inches square, you step deep into a loose pile of it; you step out with little apparent effort. A little to your right and extending downwards from the ceiling is a pipe with a loose valve hanging to the end of it and palpitating like the tongue of a hot dog. This and others around supply the apartment with air. Upon your left a man is shovelling sand into a trough of water. Into this trough is encased the lower end of an iron pipe which drops from the ceiling. Near the top of this another pipe, which comes through the masonry parallel with it, turns into it and a little upwards. This is the sand pump. All the sand which the man throws into the trough is sucked up by the vacuum, created by a stream of water which comes down the second pipe, and is projected upwards through the first.

And so this goes on regularly for days: the sand being excavated, the caisson with its load of stone sinking, and the masonry added continually until the rock is reached. Then men say that "another engineering epoch has occurred. The east and largest pier of the St. Louis Bridge has safely reached the rock through a depth of ninety feet."

Still walking around, you notice that the peculiar bright appearance of the sand comes from the fact, that although the air pressure has driven all the free water from its interstices, a film surrounds each grain, retained there by an adhesion superior to the pressure, which brightly reflects the yellow light from the candles.

Now talking of candles reminds us of the Chief Engineer's remarks upon the danger of fire, in this triply compressed air, and his experiments thereon. These, moreover have been noticed as not agreeing with the experiments made by Dr. Frankland (Philosophic Transactions, 1861). As this subject must become of importance, in view of the increased use of compressed air in hydraulic construction, it may be well to lightly compare the two series of trials, and show that there is no discrepancy, but an actual agreement. Captain Eads plainly speaks of the danger of fire, and instances several cases where the clothes of the men had actually caught the flame, as showing the increased combustion arising from the increased supply of oxygen.

Dr. Frankland, in the above mentioned memoir, on the contrary, shows that from the rarefied air upon the top of Mont Blanc to the laboratory condensation of three atmospheres, there was no more tallow consumed and therefore no more combustion in the one case than in the other, and that the quantity agreed precisely with the quantity of material consumed under the normal pressure. The discrepancy, however, is explained by the very reasons deduced from his experiments, which he gives as the decreased mobility of the atoms of oxygen arising from the increased condensation. It is plain enough that, other laws being equal, the mobility of the particles may be in exact inverse ratio to the density, in which case the combustion will remain the same through all changes of pressure.

But would Dr. Frankland's experiments, if, instead of being conducted in a bell glass practically air tight and the pump stopped as soon as the desired pressure was obtained, made with a bell glass leaking at every pore, so that the pump would constantly have to supply the deficiency, with moving figures flitting from place to place, always in motion and constantly breathing, with the test object—the candle—continually changing its position, and sometimes blown upon with a strong blast from the lungs, with the figures violently agitated when the fire touches them—would, we say, his experiments have given the same result? It would seem not; for then the mobility of the oxygen particles would not have been decreased with their density. The action of leakage, the effect of moving bodies, would have restored the mobility, and we should have three times the oxygen with nearly the same, and not one third, the mobility, and consequently nearly three times the combustion.

There is, therefore, great danger from fire in compressed air, and a strong light, which could be retained in one place where the air is still, is a desideratum.

But we have now visited the subterranean chamber and seen its wonders, and so returning through the air lock, where the letting off of pressure does not affect the ear, we are at the foot of the spiral staircase.

Here comes the tug of war. Your strength which has been increased by the compression, has now fearfully diminished. You are weary and without nerve for the ascent. You feel, indeed, as a wet rag might feel if suddenly brought to a consciousness of its limpness. So with sloth you drag your weary way to the top, and finding the air still bleak, and wet, and Novemberish, and that when you get upon the streets your umbrella is twisted in every direction by the wind save the direction from which the rain comes, you wish you were back again deep under the river, with a plentiful supply of tempered air, strengthened with oxygen, and a steady umbrella over your head capable of turning aside the northwest wind and the full flow of the Mississippi River.

SARDINES, Where They Come From and How Preserved.

There are few delicacies so well known and so highly esteemed as the sardine. The delicious flavor of the fish when the tin is first opened, and the sweetness of the oil (always supposing a good brand), print their charms upon the memory. It will be an unwelcome news, however, to many to be told that anything good in this way is exceedingly scarce this season. Unfortunately, it was the same last year. Then the destroying demon of war took away the fishermen from the villages, and, added to this, the fish were scarce, so that more were contracted for than could be delivered. This year it is worse. Few fish of any size have been caught (except some very large), least of all those of the finest quality. The consequence is, that the French manufacturers are again unable to carry out their contracts.

The fishery, says the London Grocer, is carried on generally from July to November, all along the west coast of France. Two of the largest stations are at Douarnenez and Concarneau. Fleets of boats go out some few miles and spread out their nets, by the side of which some cod roe is thrown to attract the fish. The nets are weighted on one end and have corks attached to the other so that they assume a vertical position—two nets being placed close to each other, that the fish trying to escape may be caught in the meshes. Brought to land, they are immediately offered for sale, as, if staler by a few hours, they become seriously deteriorated in value, no first class manufacturer caring to buy such. They are sold by the thousand. The curer employs large numbers of wo-

men, who cut off the heads of the fish, wash, and salt them. The fish are then dipped into boiling oil for a few minutes, arranged in various sized boxes, filled up with finest olive oil, soldered down, and then placed in boiling water for some time. Women burnish the tins; the labels are put on, or sometimes enamelled on the tins, which are afterwards packed in wooden cases, generally containing 100 tins, and then are ready for export.

It does not always seem to be remembered that the longer the tin is kept unopened the more mellow do the fish become; and, if properly prepared, age improves them as it does good wine. But if they are too salt at first, age does not benefit them—they always remain tough. The sizes of tins are known as half and quarter tins. There are two half tins, one weighing eighteen ounces and the other sixteen ounces gross. The quarter tin usually weighs about seven ounces, but there is a larger quarter tin sometimes imported. Whole tins, and even larger ones still, are used in France, but seldom seen here.

As is well known, the sardine trade is an important branch of industry, very large quantities being consumed in France; and the exportation to England and America is truly wonderful.

Proposed Ship Canal in Russia.

Under the heading of "Internal Navigation in Russia," *Le Moniteur des Interêts Matériels*, published in Brussels, gives the following article, which we translate:

"Since the completion of such immense works as the piercing of the Isthmus of Suez and the Mont Cenis, simply and easily done in a few years, none of the gigantic enterprises which our ancestors dreamt of, and for many years considered impossible, are likely to frighten engineers or capitalists. The union of the two seas in the south of Russia, has been, as is well known, ever since the time of Peter the Great, the 'holy wish' of the Government of Russia. Of what importance to the great empire would a canal, permitting her to send her fleets into all the ports of Persia, and giving a support to her power in the East, be! And what an accession of power would result from the possibility of carrying, to one destination, the united fleets of the Black and Caspian Seas!

"From commercial and industrial points of view, we might predict a great future for such a canal; for a sea, hitherto closed, would be open to all maritime nations; and their vessels could, without discharging cargo, penetrate into the heart of Asia, and also carry to the West all the products of Persia and Central Asia. Russia has only too many reasons to favor such an enterprise; and accordingly the Czar instituted, in 1864, a commission charged to consider the feasibility of the project. The chief of this commission, M. Blums, believes the plan to be practicable; and, if we study the map with a little attention, the immensity of such an enterprise reduces itself to proportions comparable to those of the Isthmus of Suez Canal.

"The distance which separates the Sea of Azov from the Caspian is about 650 or 700 Russian versts, or 700 kilometers (about 441 miles). The Isthmus of Suez is 150 kilometers across. But two important rivers, the Manitscha and the Kooma, both take their rise in the Caucasus, and empty their waters respectively into the two seas; and using their streams would permit a considerable abridgment of the labor. The engineering difficulties will probably be greater than at Suez, where the highest rise in the level was only 20 meters. It will be necessary to leave a much larger margin for contingencies, and it is well known to what an amount these came in the earlier work. Still other new problems present themselves. Here, however, are the figures given by the engineers of the abovementioned Russian commission:

"A canal can be constructed from one sea to the other for 81,000,000 silver rubles (about \$60,750,000). The measurement of the soil to be removed will amount to 550,000,000 cubic meters (about 720,000,000 cubic yards).

"The Russian Government cannot, at present, hope to see other nations concurring in this enterprise. Foreign commerce will naturally prefer the shorter and better canal of Suez; but the junction of the Sea of Azov to the Caspian is of such importance to the Russian empire, both from political and commercial points of view, that the Government will not shrink from a considerable expenditure. And it would be in Russia itself that the greater part of the needed capital must be sought; and it would there be possible to obtain it, by insuring, as has been done to the railway enterprises, a sufficient interest for the money. It would be easy, moreover, to promote, in the countries which the canal is intended to unite, the creation of banks and other commercial establishments, by the concession of lands and of facilities of transit. The question is of permanent importance to Russia, and from the present state of public opinion in that country, and from the spirit attributed to the Government, it will probably be answered in a sufficiently short time."

A Square Toed Plan for Making Money.

A Boston boot and shoe firm, which has an extensive Northern reputation by reason of its loyalty, lately hit upon an ingenious plan to push their trade in the South. They invented a sort of a square toed boot, on the log of which was imprinted the likeness of Gen. R. E. Lee, and this was to go into the general Southern market. A finer boot was then made with the picture of Stonewall Jackson, also imprinted on the boot leg, and this was intended especially for Virginia dealers. The firm then applied for a patent on their trade mark. The Examiner to-day decided that the application could not be granted on the ground that these trade marks tended to encourage disloyalty in the South. The firm have taken an appeal to the Commissioner.

Comparative Merits of Narrow and Regular Gauge Railways.

Mr. Silas Seymour, the well known consulting engineer, was lately applied to by Mr. Marshall O. Roberts for his opinion on the subject of narrow gages for great trunk lines of railroad. Mr. Roberts, as President of the Texas Pacific Railroad Company, had received from the chief engineer of that company, General G. P. Buell, a report in favor of the narrow gage of three feet six inches, the reasons for recommending it being, first, that, in the construction of the road bed, the difference of cost will be 30 per cent in favor of the narrow gage; second, in the construction of the superstructure, the difference of cost will be 45 per cent in the same direction; third, with proper construction of rolling stock, a speed of thirty-five to forty-five miles per hour can be attained with perfect safety on the narrow gage; fourth, the construction of rolling stock will cost 50 to 55 per cent less; and, fifth, in loaded trains of mixed freight and cars on the 3 foot 6 inch gage, the percentage of dead weight to load will be about 47-100, while in a similar train on the broad gage it will be about 75-100.

Mr. Seymour does not agree with General Buell either in his premises or his conclusions, and proceeds to take up his "five reasons" and dispose of them one after another. After speaking of the difficulty of making any practical comparison he takes up the matter of the cost of the road bed. The side slopes and embankments, side drains, berms, wings, end walls, and coping of culverts, he says, would cost the same in both cases, as would also truss bridging, as that used on the broad gage road is as narrow as will allow of the requisite lateral bracing to keep the bridge in perfect line and adjustment. The difference in cost then he declares to be, at the most liberal estimate, only the cost of a strip in the middle about a foot and two inches wide, which would be less than 10 per cent of the whole. The saving in the cost of the superstructure, he then proceeds to show, would be only the value of one foot and two and a half inches in length cut from the middle of each tie, as the same weight of rails is required in each case for trains of the same weight, and any advantage to be gained by multiplying trains and using lighter engines is equally applicable to both kinds of road. In the matter of cars, he claims that fully as much is lost by the necessity of using a larger number as is gained in the lower cost of smaller cars. The cost of locomotives, providing the same power is used, will be no greater for the wide than for narrow gage; and if there is a difference, it will be in favor of the larger engines. In dealing with the third reason of General Buell, Mr. Seymour declares that he does not think that "thirty-five to forty-five miles per hour with perfect safety" can be attained on any road, and that it is generally conceded that "in the ordinary condition of our roads and rolling stock a wide gage is the safest for high rates of speed."

The fifth and last reason of the chief engineer of the Texas Pacific, in favor of narrow gage, is characterized as the weakest of all the arguments advanced in its favor. There is no means, says his critic, for making any satisfactory test in this matter, but he ventures the opinion that a platform ten feet in width, of the same proportionate strength as one of the same length and five feet wide, will be found to be of less than twice the weight, and that less than twice the power will move it. The same is true of box cars and saloon coaches to a greater degree, and the conclusion is that the disadvantage of a greater proportion of dead weight is wholly imaginary. Mr. Seymour declares that all the advantages claimed for narrow gage roads can be realized with greater economy and safety by using the same character of rolling stock on the 4 foot 8½ inch roads, and that the slight additional cost of construction of the road would be more than overbalanced. The advantages which he claims for the 4 foot 8½ inch gage over that of 3 foot 6 inch he sums up as follows:

1. If commercial advantages are to be gained by exchanging cars with connecting lines, you would be in a condition to secure them.
2. A train, like a wagon, may be hauled much easier with wheels of large than small diameter. This width of gage allows of considerably larger wheels, under its ordinary rolling stock, than are admissible upon the narrow gage; but with this proposed reduced height of cars upon the wider gage, the wheels may be made so much larger that a very material saving will be effected in power.
3. Having a greater base of track in proportion to the height and width of your cars, the irregularities in the track would be less apparent; and you would certainly make as fast time with greater safety, or faster time with equal safety, than you could upon the narrower gage.
4. The height and width of train being less than that in general use upon the wider gage, the atmospheric resistance would also be proportionately less; and you could make faster time with the same amount of power than is made upon the ordinary 4 foot 8½ inch railroads.
5. You would relieve the entire question, or at least the wider gage portion of it, from the enormous load of extra dead weight which it has heretofore been compelled by its adversaries to carry, because under this arrangement it would evidently be reduced to merely the weight due to the extra length of axles.
6. If time and experience should happen to demonstrate that your chief engineer is wrong in his present convictions upon this subject, you could correct the mistake hereafter at much less expense than you could if the grading, masonry, superstructure, rolling stock, etc., were all adapted to the narrow gage.

The subject, as presented to the mind of the engineer, naturally divides itself into four general propositions: First, comparative cost; second, comparative facility and economy in packing or loading; third, comparative economy in haul-

ing; fourth, comparative advantage of a gage common to connecting lines. As to the first, he admits that the advantage is slightly in favor of the narrow gage, but to nothing like the extent claimed by the advocates of the extreme narrow gage theory. As to the second, he claims that the advantages are so greatly in favor of the wider gage as to far outweigh the additional cost of construction. He believes that rolling stock for the wider gage can be constructed cheaper and of less weight in proportion to its comfort and capacity than rolling stock of the same relative width, strength, and durability adapted to the narrower gage, and that it can be used for equal rates of speed with greater safety. He believes that there is a great deal of unnecessary and non-paying weight carried, and a good deal of useless friction to overcome on all railroads, but does not think it altogether chargeable to the width of the roads. He concludes by recommending for the Texas Pacific Road a 5 foot gage as better still than the 4 feet 8½ inches. Mr. Seymour fortifies his views by a liberal citation from the arguments of other eminent authorities on the subject.

Chills and Fever.

Hall's Journal of Health, for November, has the following seasonable article on the above subject. Chills and fever and bilious fevers have prevailed to an unusual extent in the vicinity of New York this season, as well as in many other parts of the country.

Dr. Hall says: It very generally prevails in the fall of the year over large sections of country. Scattering cases are liable to occur anywhere. These arise from individual indiscretions; but where large numbers of persons in communities are attacked, there some general cause must prevail. This cause has been attributed for ages to "miasm," an emanation from the earth so subtle in its character, that for more than a century the greatest skill of the ablest chemists was not able to detect its nature or define its quality. A bottle of air taken from the most deadly localities was submitted to the most careful and searching analysis without the detection of anything solid, gaseous, or liquid; nothing could be found in the bottle but air, thin air. But the microscope has come to the aid of the alchemist, and has discovered in this, the miasmatic air, multitudes of living things. When bottles of this air were taken from the banks of a Southern bayou, and placed in the chamber of a man in Chicago by Dr. Salisbury, he was taken with chills and fever in a few days, and these living things were found on his tongue and within his mouth; while not a single one was to be found all over the city, except in that one man's mouth, in his chamber, and in the bottles. Whether this life is animal or vegetable, is a matter of dispute, yet it seems capable of producing chills and fever; but whether animal or vegetable, the laws which regulate the action of miasm on the human system remain the same, and the mode of production, or the causes of the generation of this miasm, remain unchanged; and these laws have been determined and described with wonderful accuracy. This miasm results from warmth, moisture, and vegetation combined; if one is absent, miasm is not formed; vegetable matter will not decay unless there is moisture, it will dry up; it will remain under water a thousand years without decay, as witness the wooden piers of ancient bridges, as sound to day as when they were driven by Adam's grandson, or somebody else who lived a long time ago. The heat must act on the moisture before miasm becomes a product. This miasm, to be injurious, must be taken into the system by breathing into the lungs, or by swallowing into the stomach. But cold, as the "first frosts" which are everywhere known to make it innocuous, condenses this miasm, makes it so heavy that it falls to the surface of the earth, and can be neither breathed nor swallowed; on the other hand, heat so rarefies the air in which this miasm is contained, that it carries it up towards the clouds, where it is no more breathed than if it laid immediately on the surface of the earth. Hence heat and cold are antagonistic to the disease-producing effects of miasm on the human body. To freeze it out is expensive, but to antagonize it by heat is possible, is everywhere practicable.

From an hour after sundown to an hour before sunrise, the cold causes it to settle on the surface of the earth. An hour after sunrise and until an hour before sunset, as a general rule, it is too high above our heads to injure us, in consequence of the heat of the weather.

As the heat must be over eighty degrees for several days to generate miasm, it follows that the time, during which we are required to battle with it, is at sunrise and sunset during the spring and fall months. But to make it safe from the first blade of grass in spring until the killing frosts of autumn, dress in a cheerful blazing fire, and take breakfast before going outside of the door; come home before sundown, take your supper before its setting, by the same cheerful blazing hearth, then go and do what you please. You may sleep under a tree, or on a swinging limb, and defy fever and ague for a century, if you only keep warm, abundantly warm.

Val de Travers Asphalt a Failure.

We see, the *London Building News* says, that the shopkeepers and others of the Strand and other parts of London are petitioning to have certain thoroughfares paved with asphalt. Now, considering the many advantages attending the use of this material for paving purposes, we are not surprised at the growing feeling in its favor, and particularly just now after a summer's experience. But we entreat all who are asking for its more extensive application to pause a little. Let them have the experience of winter as well as summer before they decide. When passing through Leicester square

yesterday (October 19) about mid-day, we saw that hundreds of people had collected. We thought at first that some procession or other spectacle must be coming. We were, however, soon undeceived, for the horses while passing over the asphalt pavement were falling down so fast as to excite a great deal of public attention and curiosity. Though we were not present more than a few minutes, several horses slipped and fell during the time, and others that did not fall were in peril of falling while passing over the pavement. Some cabdrivers as soon as they got on the asphalt cautiously turned back again, others turned away at the very first turning, and all that passed over had to do so slowly and with extreme care. We don't know whether the same kind of pavement in other parts of London is so dangerous during humid weather as that recently laid in Leicester-square: if so, the demand for tearing it up will very soon be stronger than that for laying it down. No doubt Val de Travers asphalt is very good for Continental cities, but for London and other large English cities, during winter, it will be found altogether unsuitable.

Lequesne's Commutator.

The elements of an electric pile can be grouped according to three classes, that of tension, of quantity, and of series. When, with the same battery, successively different effects are produced, or when the action lasts long enough to show a sensible decrease of energy, the groupings of the elements can be changed according to the variations of power or of resistance. The change involves a marked loss of time when it is necessary to produce it by manoeuvring the wires of the electrodes. But one can obtain the commutations for obtaining various grouping by the simple movement of a handle. M. Lequesne is the inventor of a commutator of this kind, and M. le Comte du Moncel states, in his report to the *Société d'Encouragement*, that it is more complete and more efficient than the similar apparatus already in use. M. Lequesne gives to his special commutator the name of Voltamériste. It is composed essentially of a cylinder, to the surface of which is applied a series of metallic plates, divided up in a particular manner with regard to the various systems of groupings of the battery, and of two systems of rubbing plates, bearing on the cylinder and in contact with the divided plates and two different generators.

The one of this series is directly in connection by wires in the positive poles of the different elements of the battery, the other with the negative poles, and it is only necessary to turn the cylinder, in such a manner as to place under the rubbing plates such combinations of the divided plates, to obtain immediately the desired grouping of the battery.

To obtain the element of quantity in the battery, it will be sufficient to bring, under the two series of rubbing plates, two continuous metallic plates of a length equal to that of the two series of rubbers. The battery will then work as if it were composed of a single element, with a surface equal to that of the whole of the elements.

To add all the elements in tension, it is necessary to have a number of metallic plates equal to half the number of the elements of the battery, all ranged on the same generator of the cylinder, and of a width sufficient for the plates of the two series to be applied simultaneously, two by two.

Lastly, to obtain a series, that is to say, to obtain from a battery of 24 elements the current which should give, for example, a battery of 8 elements of threefold the surface, it is necessary that the divided plates alternate from the one to the other series of rubbers as many times as there are series of elements, for instance, eight times, in the examples given above.

M. Lequesne constructs the apparatus for 24 elements, and combines them together when he operates with batteries of a greater number of elements. He places in his cylinder eight series of plates, permitting eight groupings by series, that form a battery of 24 couples.

Speed of Carrier Pigeons.

The *Newark Advertiser* gives the following: The wonderful flight of the carrier pigeon Tempest to Montclair, N. J., was noticed some time since. We have now to record the still more extraordinary time of two other birds sent home. The following notes were found on them on their arrival:

DEAR FATHER—Sept. 15, 1871—Lat. 27 deg. 10 N., long. 79 deg. 30 W., 1,004 statute miles from Montclair, N. J.—I will let the male bird Tornado go with this note at exactly nine o'clock A. M., New York time. I let the bird Tempest go on the 10th. She rose up about 500 yards high, and then made one tremendous plunge to the North, and was out of sight about as quick as a flash of lightning.

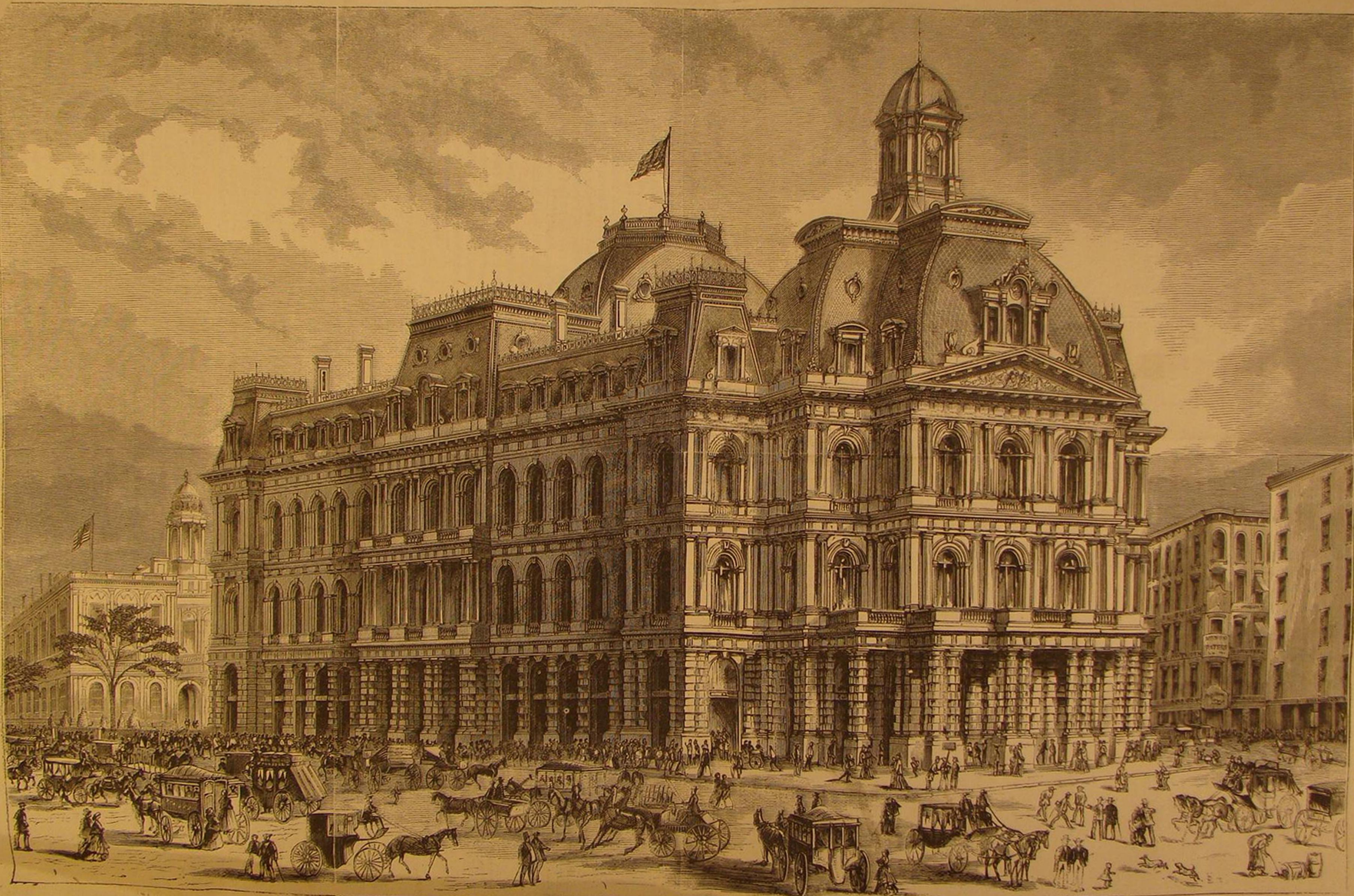
HARRY C. BLEECKER.

DEAR FATHER—Sept. 21, 1871—Lat. 26 deg. N., long. 93 deg. 5 W., 1,596 statute miles from Montclair, N. J.—I will let the old bird Typhoon go with this note at exactly eight o'clock A. M., New York time. He is a powerful bird, but he has a fearful job on hand. He must go through it or perish. All well.

HARRY C. BLEECKER.

The bird Tornado arrived at Montclair the same day at three o'clock and seven minutes P. M., making over 196 miles an hour. Typhoon arrived the same day at three o'clock and fifty-four minutes P. M., and fell dead on his arrival, but he brought the note in the unprecedented time of 202 miles an hour.

ELECTRIC LIGHTS FOR SHIPS.—M. Marten suggests the plan of attaching to sailing vessels a screw propeller, the motion of which shall be obtained from the movement of the ship. The author proposes to utilize the power so obtained, in giving motion to an electromagnetic apparatus, from which such vessels may be supplied with the convenience of an electric light, thus dispensing with the use of oil, and gaining besides the advantage of the greatly increased illumination.



THE NEW CITY POST OFFICE.—(See Next Page.)

THE CHICAGO WATER WORKS AS THEY APPEARED BEFORE THE LATE FIRE.

This building, which was, before its destruction, entitled to be considered one of the representative buildings of Chicago, has acquired renewed interest from its connection with the recent catastrophe, and we herewith append an engraving of it.

As our readers are aware, the city supply of water was drawn through a conduit from the lake, the water being taken two miles from the shore. Previous to the construction of these works, the water supply had been of inferior quality. Their completion furnished an abundance of pure, wholesome water to all parts of the city.

In all their appointments these works were as complete as any in existence, and were the pride of the city.

THE LAKE TUNNEL.

The plan of tunneling two miles under the bed of the lake was proposed by E. F. Chesbrough, Esq., the city engineer, and was executed under his superintendence. It is one of the most novel, successful, and economically executed engineering enterprises of the time.

THE PROGRESS OF THE WORK.

Ground was first broken for the work on the 17th of March, 1864, when the construction formally commenced. The iron cylinders, which had been ordered to protect the land shaft against the influx of the very wet sand and gravel known to overlie the clay for about twenty feet, did not arrive till after two months of detention. The progress at first was much slower than was anticipated, owing to the troublesome nature of the sand and gravel; but the hard clay was reached about the first of April, and the iron cylinders had been sunk through the sand. No serious difficulty afterward arose in the prosecution of the land shaft and shore end of the work. At the end of the year the tunnel had been finished from the land shaft out under the lake 2,139 feet, and July 10, 1865, it had reached 3,023 feet, and was extending outward at the rate of about twelve feet per day. August 25 it had reached a distance of 3,505 feet, and the masonry was about twenty-five feet behind the face. In some places an average rate of progress of fourteen feet per day was made for a week at a time, but for the whole period this average was considerably less, owing to occasional interruptions from the breakage of machinery, strikes among the workmen, the meeting with and occasional explosion of gas, and other causes. The average for the year ending April 1, 1865, was thereby reduced to nine and one tenth feet per day.

The back filling between the regular brick work and the irregular surface of the excavation of the tunnel, which was originally intended to be of well packed earth, was made of masonry, because it was found very difficult to get the puddled clay used, faithfully packed into the spaces. The ground generally was so uniform and favorable for excavation that the tunnel was cut with great precision, and an average of one inch thickness of cement mortar between the bricks and the clay walls was all that was required.

A tendency in the clay to swell was found at an early stage of the work, but the masonry resisted it perfectly. It, however, gave some trouble in the grading, for one portion would swell more than another. In order to facilitate the work, chambers and turn tables were placed at intervals of one thousand feet. These were used for the storage of materials and for mixing cement, and for turn-out tracks for the cars. As the work progressed iron rails were substituted for wood in the tram ways, and small mules were used to draw the cars instead of men. By all these facilities the economy and rapidity of execution of the work were increased.

VENTILATION.

The ventilation of the first half mile of the tunnel was effected by drawing the vitiated air out through a pipe connected with the chimney of the boiler furnace, but toward the last this method was found to be so ineffectual and unreliable that it was abandoned, and one of Alden's blowers was used with complete success.

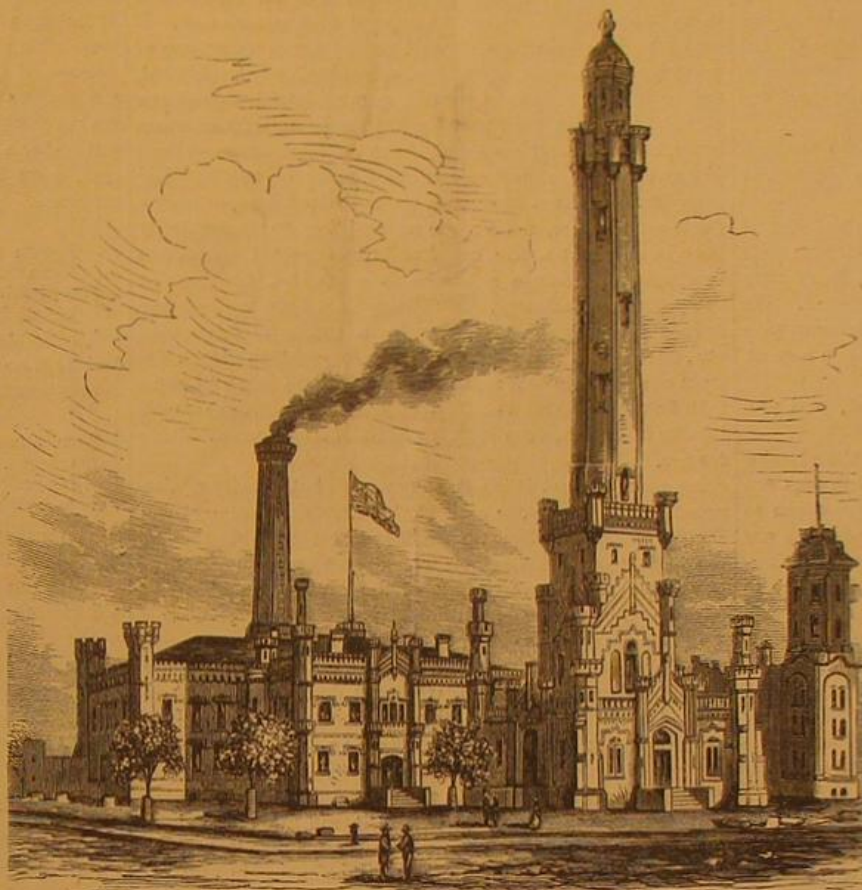
PLACING THE CRIB.

The crib through which access was to be obtained to the bed of the lake for the excavation of the tunnel from that point shoreward, simultaneously with the progress of the shore end, was not placed in position before the 25th of July, 1865, when it was launched and towed out to its place in the lake. The work of sinking was delayed somewhat, in consequence of defective arrangement of and accidents to the anchors. Just as it reached the bottom a storm came on, and as the crib was not sufficiently loaded to rest firmly upon the bottom, it was filled with water, by means of a wrecking pump. After the storm had subsided, it was found that the crib had moved thirteen feet north of its true position, and that it had become firmly imbedded in the clay of the bottom of the lake. It was therefore deemed best not to disturb it, as the variation from the exact position was of no practical importance, and it was immediately filled with stone. It was afterward built up three feet higher, so as to be secure from the wash of the waves, and it was covered in by a building to serve for the protection of the workmen, the materials, and machinery. The seven iron cylinders making the iron part of the shaft, and sixty-three feet of it in height, were

connected together, one by one, and lowered inside of the crib, to the bottom of the lake, within the thirty feet wide open space in the centre of the crib. The gates or valves, by which the water of the lake is admitted to these cylinders, are placed near to their upper end.

After the cylinders had been placed in the right position, they were forced downward into the clay some twenty-five feet, the water being wholly excluded. The masonry was then commenced. In the meantime the engine for hoisting, and the necessary machinery, were made ready, and the bricks, cement, and other materials and supplies were collected and stored in the building, upon the top of the crib. For all these preparations a much longer time was consumed than was anticipated, and the work upon the tunnel at the end did not commence before the first of January, 1866, after which the work steadily progressed.

In commencing the lake shaft end of the tunnel, it was excavated for about sixty feet, to the eastward, in order to



CHICAGO WATERWORKS AS THEY APPEARED BEFORE THE FIRE.

facilitate the alignment. The ground at the lake end was found to be very similar to that at the other, but more liable to cave in, and consequently, rather more difficult and expensive to work.

The masonry uniting the two parts of the tunnel was formally closed up December 6, 1866, by his honor Mayor Rice, and the citizens were permitted to inspect the work. There then remained the side chambers to be filled up, and the entire tunnel to be cleaned out. This was all carefully done, and the water was first let into the tunnel, from the lake, on the 8th day of March, 1867, and on the 11th it was filled to the level of the lake. The water was then pumped out sufficiently to allow a boat to pass upward of half way from the crib to the land shaft. Not a brick was found to be displaced, and it could not be perceived that the slightest fracture had anywhere taken place by the pressure to which the masonry had been subjected. As it was very desirable to use the tunnel as soon as possible, it was thought unnecessary to pump out the whole of the water, and the tunnel was again filled. The formal and public opening took place on the 25th of the month, and since that time Chicago has been free from the annoyances of impure and fetid water. The buildings for the pumping engines and water columns were unusually commodious and beautiful, and were constructed of stone in the castellated style, from designs by W. W. Boyington, architect.

Two double acting pumps, twenty-eight inches in diameter and eight foot stroke, were used. The cylinders were forty-four inches in diameter, and their stroke the same as in the pumps. They took their water from a pump, or well, lined with brick and communicating by means of a curved tunnel with the main lake tunnel through the shore end shaft.

The following description of the burning of the building is extracted from an interesting book entitled the "Great Fires of Chicago and the West," of which the reader will find a notice in another column of the present issue:

Before tracing the progress of the fire further northward, must be mentioned the burning of the water works, and the curious, or rather incomprehensible, manner in which it caught fire almost two hours before the time that the fire first reached the north division across the main branch. As stated above, the Galena Elevator, at the edge of the main branch, caught fire from the south side at about 20 minutes to 6 o'clock. At about 20 minutes before 4 o'clock a fire was discovered in the carpenter shop of Mr. Lill, built on piles above the shallow water of the lake. Standing between the burning carpenter shop and the water works, extending northwest of the shop, stood one of Mr. Lill's book keepers. Turning round toward the water works, he exclaimed, "My God, the water works are in flames!" This gentleman states positively that the flames from the water works, when he first saw them, were issuing from the western portion of the

pumping works, no flames being seen from the eastern portion of the grounds, which were occupied with coal sheds etc. On the other hand, the employes at the water works say that the fire commenced about half past 3 o'clock in the morning; that it commenced in the eastern part of the water works, which took fire from the shed. Another gentleman testifies that the carpenter shop, or the cooper shop, as he called it, was burned down before the fire commenced in the water works, and that when the water works were in full flame, the main body of Lill's brewery, with the exception of the carpenter shop, was intact. The time of the commencement of the fire in Lill's carpenter shop and the water works, however, differs one hour; the last named witness asserting that the water works commenced burning at about half past 2 or 3 o'clock. But whatever may have been the origin of the fire at the water works, it is certain that when it did commence the whole building was soon in flames, and in a few minutes the engineers had to rush out of the building to save their lives. The machinery was very considerably injured. The water tower, however, to the west of the pumping works, was almost entirely uninjured.

Our readers will find, in another column, an interesting letter referring to Holly's system of fire protection and water supply, with some remarks on the water system of Chicago, which will be interesting in this connection.

Chameleon Barometer.

M. Lenoir, of Paris, an inventor as fertile as ingenious, and who is especially known by the gas engine that bears his name, and by a system of autographic telegraphy, has just introduced a kind of barometer which at least has the merit of ingenuity. It is composed of a dial, in the centre of which is traced a circle, the diameter of which is almost half that of the dial. The annular space comprised between the two circumferences is divided into four sections; on the lower one is inscribed the name of the inventor and that of the apparatus, "*baromètre caméléon*;" the compartment to the left is pink, and bears the inscription "much rain," the top one is gray, with the word "variable," and that on the right greenish blue, with the words "set fair." The paper in the center circle changes color according to the state of the atmosphere, conforming to the tint of one or other of the three colored compartments, according as it may be very damp, tolerably dry, or extremely dry. The apparatus is, in fact, more a hygrometer than a barometer. The change of color in the central paper is produced by atmospheric humidity. This sensitive paper is prepared with a mixture of chlorine of cobalt and of marine salts, added to glycerin to attract the humidity. Salts of cobalt, nickel, copper, etc., are largely employed in the production of sympathetic inks, with which writing or drawings can be made, invisible at ordinary temperatures, but which are made visible under a slight heat, and which disappear when the temperature falls.

THE NEW CITY POST OFFICE.

In architectural importance this building is, perhaps, only second to the Capitol at Albany, among those now projected and in process of erection on the continent. Built of granite in the most substantial manner, it is probably one of those structures that will long rank as a prominent feature of interest in the American metropolis. Our office commands a distinct view of the building and the progress of the work; and, from the general interest manifested by those who daily visit us in the course of business, we are assured that our distant readers will be glad to see the engraving of this magnificent building as it will appear when completed.

The building stands at the south end of the City Hall Park, and fronts both Broadway and Park Row.

It is built, with some modifications, in the style of the classical Italian Renaissance, with French roof. Three stories, in different styles of the Doric order, are placed one above another, the ornamentation increasing in richness towards the top of the building.

In plan, the structure is that of a triangle, with the apex truncated, the narrowest frontage looking down Broadway towards the Battery. In the center there is a triangular court along the main story. There will be a sub-basement, basement, and three stories, surmounted by the roof story.

On the side fronting the City Hall, there is a wide driveway, so that the building stands, and will remain, entirely isolated from contiguous structures, and may be approached from every side. A large entrance will be left at the southwest front, communicating with an ample corridor, and surmounted with a handsome portico. There will also be two other principal entrances, one at the corner pavilion on Broadway and another at the corner pavilion on Park Row. These entrances communicate with broad elliptical stairways, leading to the upper stories. Lateral entrances will also be provided on Broadway and Park Row, and to the delivery offices on the Park front.

The sub-basement and basement extend under the entire building, central court, and sidewalks. The former is lighted and ventilated through ample areas under the sidewalks and court, and will be used for the reception of fuel, heating apparatus, boiler, and steam engine. The Post Office proper will occupy the basement and principal story. The latter in-

cludes the whole space of the building including the court. The court will be roofed with glass. The walls and partitions above this story rest on iron columns, leaving the whole space on the lower floor open for light and free communication.

A broad corridor will extend about the lower floor on the southwest, reaching to and including the central pavilions; it will surround a box and delivery screen. This corridor will be only one half story high. Above it the remainder of the story will be formed into a gallery looking inward to the delivery rooms.

Corridors encircle the building in each of the upper stories, bounded on the exterior and interior by rooms lighted from the street and central court.

The rooms of the Postmaster, Deputy Postmaster, and Cashier will be over the principal entrance at the southwest. The Park front rooms will be occupied by the United States Courts. Three court rooms will be provided, two of which will be the height of two stories. Adjoining these rooms will be special apartments for the judges. The remainder of the second and third stories will be occupied by offices for United States Marshals and other officers, United States attorneys, clerks, and other officers connected with the courts; and the jury rooms will be in the third story.

The work has proceeded slowly owing to various obstacles, some raised by the city authorities, but it has now reached to the second story.

As our readers will see, the lower part of the building is open to the criticism that its numerous angles will form most efficient dust traps. This will inevitably impart a dingy dirty appearance, which will greatly mar the effect designed. We regret that some other design for this story, in harmony with the rest of the design, yet not liable to the objection named, was not adopted.

Barring this defect, the edifice, when completed, will present a majestic and imposing appearance.

Stone, iron, and brick are the materials used; the exterior is of granite. One hundred and fifty-nine iron columns are placed in the basement, and one hundred and seventeen to support the partition walls and floors. The foundations are of granite and concrete, and are of the most substantial character. The floors will be of brick and iron, the stairs are to be of stone and iron, the roof of iron, covered with slate and copper. The building is to be heated by four large low pressure steam boilers.

The roofs of the corridor pavilions rise 107 feet above the sidewalk. The foundation of concrete is laid 35 feet below the sidewalk; the cellar is a little more than 7 feet in the clear, the basement 16 feet, the public corridor 14 feet, and the mezzanine, or gallery above, nearly the same. The outer circuit of the building will be over one fifth of a mile.

The granite comes from an island off the coast of Maine, where 600 men are employed in quarrying and dressing it. No stone cutting is done at the building. When the blocks arrive, they are ready to hoist into the places prepared for them. Derricks, worked by steam engines, are arranged in such a way that it requires only one man to set all the stone which 600 men are cutting.

The north front of the building will be 290 feet in length, the Broadway front 340 feet, and the Park Row front 320 feet in the clear. On each of these two fronts, however, there is an angle, which, running back some distance and then projecting, forms the entrance looking down Broadway. The entire width of this front is 130 feet. These entering angles and projecting portico will give this front a very bold and striking appearance.

The Doctrine of Metempsychosis.

At the time of the death of Mr. Louis Bonard, an ingenious mechanic of this city, we called attention to his bequest, to the Society for the Prevention of Cruelty to Animals, of \$100,000. The testator's relatives are disputing the validity of the will on the ground of insanity, and rely partly upon the alleged belief of the deceased in the transmigration of souls. Dr. Clymer was examined as a witness, and, on being asked if he considered such a belief to be a mental delusion, replied:

"I will tell you in my own way. It appears that opinion was at one time a very common doctrine. In modern times we know it more as the doctrine of Pythagoras, but he got it from the Egyptians. Now, it is told, they were the first who believed in the immortality of the soul, and that this was the first expression of such belief. They held that the soul, being immortal, when it leaves the body, enters another, and never ceases to be removed from one to another. Metempsychosis implies the passage of that soul into animals successively, and, according to some who held the doctrine, again returning, after certain purifications by its progress through these animals, to the human form; and this was one of the reasons why the Egyptians preserved their mummies. This doctrine was held by the Druids of France, Britain and Germany, and is held by the Brahmins, and, in more modern times, by Fourier, and his disciples in France. Origen, one of the Fathers of the Church, held it, and some theologians endeavored to prove it as held in the New Testament, from the 9th chapter of St. John, and others say the doctrine of purgatory originated in this way. Our own Christian doctrines are held variously. What one believes, another thinks a delusion, but a medical man, finding no evidence of delusion generally, would not be warranted in saying such a person labors under mental delusion. The transmigration of souls was held by some of the first minds in ancient and modern times, and I do not consider a belief in it necessarily implies that he was laboring under delusion."

You may glean knowledge by reading, but you must separate the chaff from the wheat by thinking.

Correspondence.

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

Fireproof Building.—How they Build in Berlin.

To the Editor of the Scientific American:

The late Chicago fire has called public attention to the subject of fireproof building; and within the last few weeks a number of articles about this matter have already appeared in the columns of your paper. It seems to me that all endeavors to find constructions which will be really fireproof—for instance, so as to stand a fire like the one in Chicago—are useless, at least as far as the majority of our buildings are concerned, for the simple reason that even if such constructions were found, they would be too expensive for our ordinary dwellings, stores, etc. If stones, bricks, and iron are considered insufficiently fireproof, we may give up the idea of building our cities of fireproof houses. The proper remedy to prevent large conflagrations is to build all houses in a city as fireproof as can be done at a reasonable cost. If only all frame buildings, as well as the unnecessary use of wood for inside work, roofs, etc., were absolutely prohibited, and no lumber yards and the like were allowed inside of our cities, the houses need only be built substantially of stone brick, and iron, and we should have no more conflagrations of any extent. In most of our cities, however, the building laws are, or at least have been up to a recent date, of such a deplorable nature, and a mode of building has accordingly been in use, that a fire can hardly be expected to remain confined to the house in which it originates. As long as party walls are allowed, and chimneys are built without any foundation, but supported only by a couple of joists, etc., etc., our houses will always be apt to communicate a fire from one to the other, as, as soon as a whole row of houses is in flames, the heat is sufficiently intense to set fire to adjoining buildings, even if they are built independent of the former.

An example that it is not necessary to build a city of fireproof buildings only, to prevent any large fires, is the city of Berlin. There has been no fire of any extent during the last ten years, the mere reason of which is an excellent building law and a strict enforcement of the same, in combination with an effective fire department.

In this country, however, even where more money is spent on a house than is necessary to construct it fireproof to a certain extent, we often find that a great deal of money is expended in such a manner as to make the building as unsafe as possible against fire. We will only allude to the "lumber piles" which are put on many houses, in the form of "French roofs." Our stores and offices are lined with neatly dressed lumber, which, to make it the more dangerous, is oiled or varnished. Is it a wonder if a safe in such an office proves insufficient to preserve its contents in case the building takes fire? Such unreasonable use of wood for the inner outfit of our houses should not be tolerated, in the same way as, in most of our cities, shingle roofs are now prohibited by law. For the majority of our buildings, lumber cannot be entirely excluded as building material, as for floors, joists, rafters, etc.; but its use should be diminished as much as possible; wooden partitions should be abandoned, and the stairways should be made either of iron or stone, and self supporting, so as to require no casing, a construction which cannot be too highly recommended.

I have been in Berlin for four years, from 1862 to 1866, and I do not recollect ever to have seen a fire there. I have often seen the engines in position, ready to go to work, but in almost all cases the fire was suppressed without bringing them into use. How does this compare with the fires in our American cities, where in one half of the cases the damage done by water is greater than that by fire?

Baltimore, Md.

H. DUEBERG.

An Appeal to Dr. Vander Weyde.

To the Editor of the Scientific American:

Professor P. H. Vander Weyde, in one of his very interesting articles upon psychic force, speaks of the Davenport brothers, and how that he had performed the same wonderful feats as those jugglers. Now, as they have astonished and excited the wonder of large audiences in nearly every city in the United States, the Professor would confer a favor upon thousands, perhaps hundreds of thousands, of his fellow citizens, if he would give a clear and full exposure of the wonderful performances of those men while in their cabinet; such as the taking off of the coat of one of them, while securely tied, and the knots sealed with sealing wax; also the putting on of another gentleman's coat while he (the Davenport) was tied fast to a chair. Of course the light was extinguished during the performance, but not longer than it would have taken a man, not tied, to put on or take off his coat. And will the Doctor also explain the passing of the musical instruments around the hall, with phosphorus on them to enable the audience to see their movements?

Americus, Ga.

J. FRICKER.

Squeaking Boots Again.

To the Editor of the Scientific American:

I have two pair of calfskin boots, both inveterate squeakers, which I have worn for a year. I tried all the known remedies, as greasing the soles, driving in pegs and nails, soaking them in water and wearing them till dry, but without success. At length a happy thought struck me. With a rag, I saturated the insoles with kerosene oil; and *Eureka et gloria!* O hallelujah! the thinnest pair gave in at once, and the other pair after the second application.

Sextons and ushers will please make a note of this, and ever cherish, with grateful remembrance, the name of the discoverer,

JONES.

[For the Scientific American.]

ABSORPTION OF MOISTURE BY BRICK AND STONE.

BY JOHN C. DRAVER, PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

In the construction of buildings in a climate like ours, it is of the utmost importance that the materials employed should absorb and retain as little water as possible, otherwise the buildings will be damp, and the presence of quantities of moisture in their walls will favor the formation of vegetable growths upon their surfaces, which will, together with the action of frost, aid materially in the process of disintegration.

In a recent experimental investigation of this subject, I selected the following materials, namely, brown stone and Nova Scotia stone of the best quality, fine red Philadelphia brick, and a very compact, hard burned, white brick, stamped A. Hall & Sons, Perth Amboy, N. J. Masses of equal size of each were placed in water for twenty hours to allow them to imbibe as much of the fluid as they could take up. They were then turned about on blotting paper as long as they dampened it. The external moisture being thus removed, the masses were weighed and placed in an air bath at 212° for three hours. On being removed from the bath, they were put under a glass bell jar, and, being again weighed when cool, were found to have lost the following quantities of moisture.

TABLE I.

Brown stone	10,000 parts, lost 260 of moisture.
Nova Scotia stone	" " " 260 "
Red brick	" " " 1,179 "
White brick	" " " 525 "

The masses were then placed in the warm air bath again, and kept at 212° for four hours. On being cooled with the same precautions as before they showed the following losses:

TABLE II.

Brown stone	10,000 parts, lost 8 parts of moisture.
Nova Scotia stone	" " " 8 "
Red brick	" " " 0 "
White brick	" " " 0 "

The masses were then placed on an iron plate, which was heated to a dull red heat and covered with a hood of tin to cut off currents of air. They were consequently exposed to a uniform temperature, which was sufficiently high to scorch paper when it was laid on their upper surfaces. The last traces of water were thus expelled, the quantities being as follows:

TABLE III.

Brown stone	10,000 parts, lost 17 parts of moisture.
Nova Scotia stone	" " " 35 "
Red brick	" " " a trace "
White brick	" " " a trace "

The conditions, to which the substances were submitted at the commencement of these experiments on drying, may be regarded as representing their state after a prolonged storm of rain in which they had been drenched and soaked with water for many hours, and Table I. demonstrates that while the brick absorbed more moisture than the stone, the white brick imbibed less than half that taken up by the red, and the brown stone a little more than half that taken up by the Nova Scotia stone.

Table II. in its turn shows that stone is far more retentive of its moisture than brick, for, while the former lost eight parts, the latter lost none. In Table III. the same fact is still more conclusively demonstrated, for against an almost imperceptible loss on the part of the brick, the brown stone lost seventeen parts, and the Nova Scotia stone, thirty five. We are therefore justified in concluding that though brick absorbs a larger quantity of moisture than stone, it is to be preferred as a building material, since it parts with the imbibed water with greater facility; and, comparing the two kinds of brick together, the white hard burned brick is superior to the red, since it absorbs only half as much water.

Passing from the consideration of the power of retention to that of absorption, I found that, on submitting the thoroughly dried masses of the last detailed experiment to the action of an atmosphere saturated with moisture at 70° Fahr. for six days, the following results were obtained:

TABLE IV.

Brown stone,	10,000 parts, absorb at 70°, 52 of moisture.
Nova Scotia stone,	" " " 45 "
Red brick,	" " " 3 "
White brick,	" " " 3 "

The conditions prevailing in this experiment may be regarded as being similar to those existing on an ordinary midsummer day when the dew point stands at 70°; and on inspecting the table we find that, while the brick absorbs but little moisture, the stone is very hygroscopic, the brown stone possessing this property in a more marked degree than the Nova Scotia. Since warmth and moisture, taken together, are peculiarly favorable to the production of vegetable growths, it follows that brown stone is, by virtue of the larger amount of water it absorbs, more liable to disintegration from this cause than the other substances submitted to experiment. In the case of the bricks the absorptive power is, as the table shows, equal, and very slight or slow in its action. They are therefore superior to stone in this respect.

To determine the absorptive power when exposed to conditions similar to those prevailing during a fog, I caused steam from a free opening to play upon them for three hours. After cooling for twenty hours, they were weighed with the following result:

TABLE V.

Brown stone,	10,000 parts, absorbed 147 parts of moisture.
Nova Scotia stone,	" " " 110 "
Red brick	" " " 127 "
White brick	" " " 106 "

Which demonstrates that under such circumstances brown stone is more hygroscopic than Nova Scotia stone, and there-

fore affords a more favorable *nidus* for vegetable growths, and is consequently less durable. In the case of the bricks, though the red brick absorbs more fog than the Nova Scotia stone, it is a better building material, since it surrenders its moisture with greater facility. The white brick, on the contrary, absorbs less fog than the others, and dries as easily as the red brick; it is therefore the most satisfactory of the building materials submitted to examination.

JOHN C. DRAPER.

[For the Scientific American.]

SOME REMARKS ON PROFESSOR CROOKES' LATEST COMMUNICATIONS.

BY P. H. VANDER WEYDE.

By the kindness of Professor Morton, of Hoboken, I had been furnished the advanced sheet of Professor Crookes' second article, of which an extract appeared in the SCIENTIFIC AMERICAN of November 11th. I was thus perfectly informed of Professor Crookes' latest arguments when I wrote my reply, to certain defenders of the psychic force, published in that same number. I mention this fact only as proof of my quiet convictions of being in the right. I did not refer to it, intending to dispose, in the future, of this somewhat new phase of the subject, and, for shortness' sake, I confined myself to that which had, so far, been brought before the readers of this paper.

As the main points of Professor Crookes' new paper have now appeared, and perhaps been digested by the readers of the SCIENTIFIC AMERICAN, I will consider them in detail, not that I personally consider the subject of such importance, but because the doctrine of the psychic force finds many adherents, whom I think it a duty to save from this novel form of superstition, if such a thing be possible.

Professor Crookes begins with using, as a motto, a quotation from Galvani, in which the latter says that, notwithstanding he is derided by scientists and know-nothings, he knows that he has "discovered one of the greatest forces in Nature." Now this quotation may seem applicable to Professor Crookes, but there are some curious differences and resemblances, which I will first notice. Professor Crookes cannot complain that also the know-nothings laugh at him; they almost all believe in the psychic force, only the great majority of the scientists are incredulous. This is a difference. A resemblance is in the fact that Galvani supposed he had discovered a vital force, a nervous fluid, in short the psychic force, and he attacked Volta and others, most violently, for trying to prove that the contact of the different metals developed an electric current, which caused the motion of the frog's legs, because the latter are, in fact, nothing but a delicate electrometer. Galvani died in the conviction that the cause which moves the frog's legs resides in the frog, and that Volta was in error to ascribe it to an exterior cause; and so Professor Crookes appears convinced that the cause which moves the spring balance resides in Mr. Home, and that others are in error who ascribe it to exterior causes. It has been recorded in the history of scientific discoveries that if Galvani had been posted in electrical science, he would have attributed the first accidental observation of the motion of the frog's legs to its true cause, the induction by the electrical machine, which was being operated at the time in the same room; but being ignorant of the laws of induction, notwithstanding these laws, at that time, were well known and established, he fell back on his old cherished hypothesis that all animals have a peculiar force residing in them; and he was so far from discovering the true theory of these electrical actions, that many well informed scientists, among them Professor B. Silliman, of New Haven, rightly object to the use of the word galvanism, on the ground that Galvani never discovered that which we now designate by that name. It is therefore proposed that Voltaic battery and Voltaic current are the true expressions to be used, and ought to supersede those now in use, which give to Galvani an honor that by no means belongs to him.

The objection was made to Professor Crookes, of rushing into print soon after having made the announcement a short time before of his intention to investigate Home's performances. Professor Crookes answers now that, within two years, he has witnessed experiments of this kind, and that he saw weights of 40 or 60 lbs. so powerfully psychologized that he and others present could scarcely lift them from the floor; that he also saw the gravitation diminished, etc. By this Professor Crookes confesses that he was already a convert to the belief in so called psychological phenomena, and prejudiced in their favor at the time that he announced that he was going to investigate Home's performances.

In regard to the increase in weight of so called psychologized substances, I can speak with full knowledge, having myself often seen such performances; and I must declare that this increase is all in the imagination of the persons trying to lift the weights; their minds were psychologized, that is, so influenced by imaginative persuasion, that their muscles were partially paralyzed. As my faith in the constancy of the laws of gravitation cannot be shaken, my mind could not become psychologized in this way, and I had never any trouble in lifting the weights, and never found any difference whatever, even when a dozen people assured one another they were much heavier than before. However, the best proof I had was to place such a mass in the balance, and challenge the mediums to increase its weight a single ounce; no one ever succeeded in doing this. They pretended to be able to increase or diminish weight, and were sustained by the assertion of many present, but their assertions were never sustained by that most reliable tool of the scientist, the balance.

And this last mentioned peculiarity of the balance must be the crucial task for the reality of the pretended psychic force.

The microscope and telescope have often deceived me, the spectroscope is giving me desperate problems to solve, but the balance is the most precious apparatus in my possession, because it always gives direct answers, and has never deceived me. Now, Professor Crookes, as chemist, has surely at least one reliable balance, decidedly more delicate than any existing spring balance; therefore it is surprising that he does not let Home exert his powers on the weights placed in the same, in place of using spring balances, which are so peculiarly apt to be used for deception, that some traders use them exclusively, and in some European countries their employment has been most peremptorily prohibited. In this way he may not only positively prove the existence of the psychic force, but correctly weigh the amount of it to within the tenth of a milligramme; with the balance he may more easily find through what substances this pretended force is conducted; and determine what are conductors and non-conductors of this force or vital fluid, as already appears to have been done in England, by Ziegler, who, six years ago, patented a battery to develop this vital force in large quantity. I am surprised that Professor Crookes is not aware of this important discovery, which is just in the line of pursuit he has now entered upon. He will find it easily in the English patent office records. Mr. Ziegler asserts that it is not electricity, as it passes through bodies which do not conduct electricity, silk being its best conductor. It may be developed independently of the human body, whenever a nitrogenized substance comes in contact with a carbonized body. To produce it he takes a number of bladders filled with liquid ammonia (the nitrogenized substance), and places them in vessels containing molasses (the carbonized substance); these bladders and vessels are connected like a voltaic battery, but by means of silk cords, around the necks of the bladders and hanging in the molasses, in this way: ammonia, bladder, molasses, silk cord, ammonia, bladder, molasses, silk cord, etc.; when now the extreme silk cords are joined, the current of psychic force, or vital fluid, is established, and men or animals placed in this circuit become very lively. This is no exaggeration, as I give the inventor's and English patentee's own words.

In regard to the principal experiments described by Professor Crookes, I will state that I have now arranged the very same contrivance, and am anxious to find a medium who can move it; but I desire psychic action on my chemical balance, produced without contact, to convince me, and then I will as readily reject my old notions, as I have rejected my former errors, which were to believe in the existence of a luminous, a caloric, a magnetic and an electric fluid.

Benefits of Co-operation.

There seems, says the *Nation*, to be a mischievous notion growing up in the minds of some of the European Governments that the International can, and ought to be, put down by force. An attempt of this kind is probably the only thing that could make it permanently powerful and dangerous. But its existence is a symptom, and a striking one, of the tendency of all political questions everywhere to merge themselves in the labor question, and the main result of the work of the International will probably be the rooting in the working class mind all over Europe that this is really the only political question of any moment. A statement was made by Mr. Nuttall, a well known leader of the co-operative movement in England, at a recent meeting of the British Social Science Association, revealing a prospect for the laboring classes which makes the schemes of the International and of the "Labor Reformers" very unimportant. He showed that in the manufacturing borough of Oldham, with a total population of seventy thousand, there were co-operative societies numbering seven thousand members. They had a capital of eight hundred thousand dollars in their six co-operative stores, and a hundred and fifty thousand dollars invested in other places. They had built seventy-five workmen's houses in the last twelve months. They have a corn-mill, large halls, and five libraries, and consultation rooms where they meet weekly for discussion. They have a capital of fifteen hundred thousand dollars, invested in cotton mills and loans; and in one of these cotton mills, which represents a capital of half a million of dollars nine tenths of the shareholders are workmen. A good question for our "labor reform" conventions to discuss would be, how many years of perorating and gadding about the country it would take to produce such results as these.

How to prevent Water from Freezing.

Boussingault relates the following experiment, conducted by him in order to test the condition of water, when cooled considerably below its normal freezing point, under circumstances where free expansion was prevented. For this purpose, a strong cylinder of steel was filled with water at the temperature of maximum density, and a steel plug tightly fitted to the opening, thus preventing, by the strength and the practically unyielding nature of the confining vessel, any expansion of the contained liquid when cooled. The sound made by the falling of a metal ball, previously placed within the cylinder, gave an indication of the condition of its contents. Under these circumstances, Boussingault found that water remains liquid even at a temperature of -18° C. (-0.4° Fahr.), but freezes instantly as soon as the plug, which hermetically sealed the vessel, is removed and the particles are allowed full freedom to expand.

WE hear from Russia that a commission, empowered especially for the consideration of the subject, has recommended the adoption of a narrow gauge on the system of railroads about to be constructed between Orenburg and the Caucasus.

Butter Making.

Fine butter is made in various ways; and it would be a public benefit if a uniform rule could be discovered and followed by all in the manufacture of butter. However, this would not render all butter of the same quality, so long as the quality of milk is so different. Breeds of cows, different grasses and other feed, will always continue the difference in milk. Hence we may always expect to find upon the market the different grades of butter usually quoted. The three following modes of caring for milk are principally followed in this State:

1. The milk is strained into pans and set on racks or shelves in the milk room.
2. The milk is strained, and set in pails, in which a small quantity of sour buttermilk is put, to hasten the souring of the milk. When this is sufficiently effected, the milk is churned.
3. In the creameries and many of the large dairies, the milk is strained into pails, about eight inches on the bottom and not far from twenty inches high. These pails are then set into vats differently constructed, into which flows a stream of cold water, which is allowed to rise nearly to the top of the pail and then flows out of the vat, so that there is a constant flow of cold water around the pails. Twenty-four to forty-eight hours is a sufficient time for the cream to rise. It is then dipped off, the cream allowed to stand until slightly sour, and churned. The same process is substantially followed by those who use the large square pan and adopt the cooler system.

Good butter may be made by either of the above modes of handling the milk. But in either case great cleanliness and care are to be observed. Where the pan system is in vogue, the milk room should be so constructed as to admit free ventilation, regulation of temperature, and light. Direct sunlight should never fall upon the milk; neither should a brisk current of air pass over it. Both rapidly dry the cream upon the surface, and convert the surface into a tough, skinny substance, which cannot be converted into good butter.

The cream should be taken off the milk, so soon as the milk is changed or slightly sour. It should never be suffered to remain until spots of mold appear on its surface and whey arises at the side of the pan. Great care should be taken to prevent any bad air to reach the milk room, as both milk and cream rapidly absorb bad air; and where it prevails, good butter cannot be made. The old-fashioned dash churn in some size is best. Churning should be done slowly, not over forty to sixty strokes per minute; and the milk or cream should be brought to a temperature varying but a little from 62° Fahr. Churning should be thoroughly done. The butter should not be removed from the churn until it is completely "gathered." It should be worked into a solid mass in the churn by the use of the dash; so that, when taken out, there will remain but a small quantity of buttermilk to be worked out. A large majority of dairymen wash their butter, and it is the best practice if you have soft water. Butter should be worked by pressure, whether it be done with the hand ladle or any kind of butter worker. The washing and working should be continued until all the buttermilk is removed. The butter should then be salted. For every twenty pounds of butter, use one pound of sifted, fine dairy salt. Work it carefully and evenly into the butter, and pack immediately.

The practice of salting butter and letting it stand from twelve to twenty-four hours, and then working over and packing, is not only unnecessary, but damaging to the quality of the article. "What is once done well and properly done, is better than twice ill done," applies in this case. The second working renders the butter "salvy." It breaks down the "grain" of the butter—and fits it for grease. Those who have practiced the above mode of working and salting their butter will not go back to the old mode. They say it is the only way they can put down their dairy and feel sure it will come out all right at the end of the season.—*Chenango (N. Y.) Republican*.

Transparent Varnishes.

The aniline colors are particularly well adapted for the manufacture of transparent lacs, which possess great intensity even in very thin films, and are hence very suitable for coloring glass or mica.

The process recommended by F. Springmuhl is to prepare separately an alcoholic solution of bleached shellac or sandarach and a concentrated alcoholic solution of the coloring matter, which last is added to the lac before using it, the glass or mica to be coated being slightly warmed. Colored films of great beauty may also be obtained, according to the author, from colored solutions of gun cotton in ether, the coloring matter being here dissolved in alcohol and ether.

The collodion film has its elasticity greatly increased by the addition of some turpentine oil; and when applied cold, can be removed entire. The colored films may now be cut into any pattern, and again attached to transparent objects.

THE much praised plant *Cundurango* and its juice have already fallen upon evil times. Violently attacked by many members of the profession as a worthless nostrum, the owners are apparently attempting to maintain its character as a quick remedy by offering it to sufferers at \$100 per pound, C. O. D., no quantity less than one quarter of a pound being sold. This is making the most of the present notoriety of the drug, and looks as if the proprietors were not anxious for time to extend and justify its reputation.

WHERE manufactures flourish, land and its products are most valuable.

Improved Portable Steam Engine.

We illustrate, in the accompanying engraving, R. Tozer's portable steam engine, to which gold medals were awarded by the South Carolina Agricultural and Mechanical Society, and which embraces in its design many features of merit that well adapt it to the uses to which portable engines are generally applied.

The cylinder is cast in the center of the steam dome, thus avoiding the use of an induction pipe. A hole is cut in the top of the boiler, which admits steam to the dome, the live steam being thus made to entirely surround the cylinder and steam chest, keeping the cylinder hot and preventing condensation therein.

A valve on the side of the steam chest admits the steam to the cylinder, and a plain cover covers both dome and steam chest.

The guides are cast in front of the dome, and bored out with the cylinder.

All parts of the engine are easily accessible, and it is very neat and compact in appearance.

It is stated to operate with great economy, and, having a long connecting rod, it works very easily in its guides.

The engine was designed by R. Tozer, of Columbia, S. C., who manufactures engines of this class, of from four to twenty horse power, and from whom further information may be obtained.

Novel Use for Worthless Safes.

The Chicago Tribune suggests the erection, in that city, upon the Ball Grounds, of an immense monument to the memory of a number of worthless institutions, late of that city, among which are the various fire insurance companies that proved good for nothing in the hour of trial, the fire-proof safe builders, whose wares failed at the critical moment, the police and fire departments, so sadly deficient in the time of need, etc. Says our cotemporary:

"All over the burnt district the prostrate forms of hundreds of conquered safes are lying, where, having faithfully performed their duties as worthless guardians of property, their ungrateful owners have abandoned them to ignominy. The idea of building a monument from them is novel and unique—more so, perhaps, than the monument itself will be, but we must not grumble at appearances. Henceforth the whole duty of our citizens will be to build every structure cheaply, fireproof, and without regard to appearance. Now, as these safes are utterly worthless—as they always were, only their gullible owners did not know it—the monument will be the cheapest possible. As they have already been subjected to a fierce heat, and have been thoroughly burnt to rubbish, there is little fear that they will burn again. It is true they are of all sizes, patterns, and qualities of badness, and makers and owners will all have a proprietary interest in the structure."

A REMARKABLE BOY MECHANIC.

We have on our table a complete working model of a horizontal steam engine with tubular boiler of the locomotive type, separate from the boiler, the workmanship of which would do credit to an experienced mechanic. Every part is stated to have been made by Master C. T. Mason (at the age of fourteen years), of Sumter, S. C. Nothing is omitted, even a miniature steam gage being supplied. Master Mason will, if he continues to progress, be a master mechanic at an age when boys in general have scarcely an idea beyond tops and marbles. He will please accept our thanks for sending his engine for our inspection, and our predictions that, if he lives, he will occupy a distinguished place among the engineers of this country. Few men could beat the execution displayed in his working miniature engine, which, in its details, indicates a knowledge of steam and the laws of its action most remarkable in such a youth. Let Master Mason apply himself diligently to the study of mathematics, mechanics, and drawing, and there can be no doubt of his future. We may add that this young mechanic received a silver medal as a first premium on this model, from the Agricultural and Mechanical Society of South Carolina at its fair of 1869.

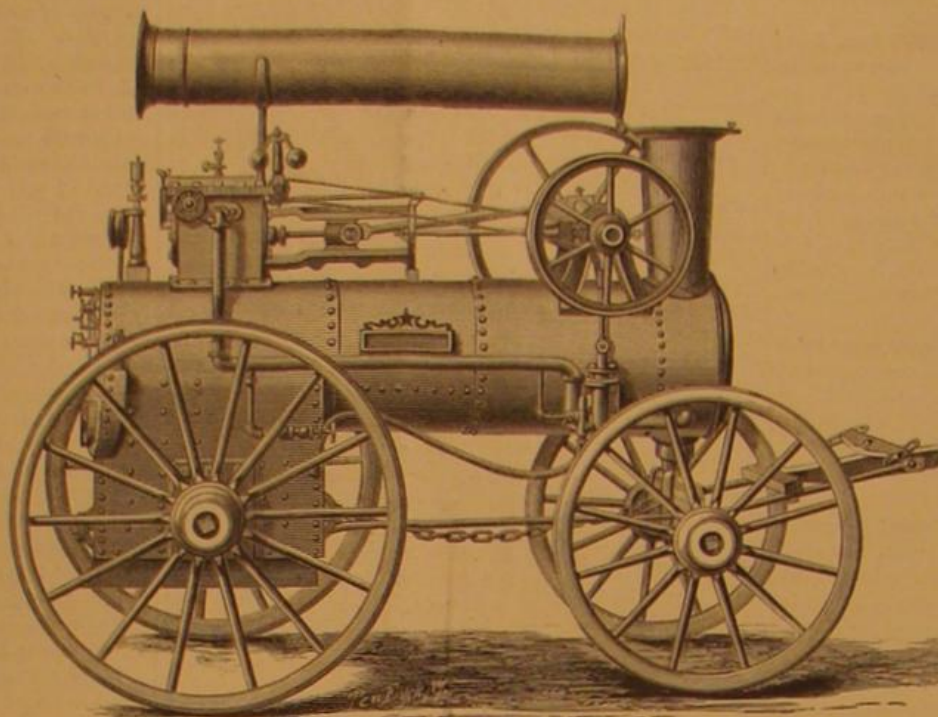
Merriam and Dietrick's Lime Kiln.

This invention has for its object to furnish an improved lime kiln, simple in construction, conveniently operated and controlled, and effective in operation, and which will allow the lime to be drawn off as burned, and from the front, side, or rear parts of the flue as may be desired; and it consists in the construction and combination of the various parts of the kiln, as hereinafter more fully described.

The lower part or draw of this kiln, which is built of stone, is about ten feet long, four feet wide, and four feet high. An inclined grate or rack is placed in the rear part of the draw to receive the lime as it falls from the flue. Two heavy plates of cast iron are made with openings in their centers, and placed above the draw and one above the other, at such a distance apart as to receive between them sliding grates or bottoms. The space between these plates is left open at the front and rear, to allow the sliding bottoms to be slid out in front or rear, and one at a time or together, to draw the lime from any desired part of the stack. Sliding dampers are secured to the sliding bottoms in such a way that they may be moved laterally, to partially or wholly enable the draft

to be regulated and the fire to be controlled, as may be desired. The stack is of brick, about twenty-four feet high and has a door, in the lower part at the front, through which the lime may be drawn. Either coke or coal may be used in the kiln as fuel, but coke is preferred, as being better and cheaper.

In charging the kiln, about a quarter of a cord of dry wood is put upon the bottom, upon which is placed a layer, about one foot thick, of limestone, then a layer about three inches thick of coal, and similar layers of stone and coal alternately until the flue is filled. The fire is then applied to the wood, and, after being lighted about twenty-four hours, will have burned about ten or twelve feet above the bottom, which be-

**TOZER'S PORTABLE STEAM ENGINE.**

comes cool. As fast as the lime is burned, it is removed and alternate layers of coal and stone added, so that the kiln may be kept burning continuously.

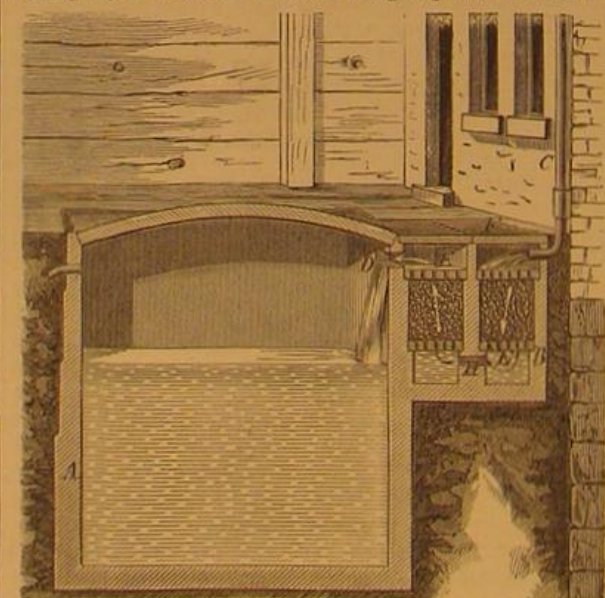
This kiln is the invention of John Q. Merriam and Abram J. Dietrick, of Fort Scott, Kansas.

SIMONSON'S IMPROVED FILTERING CISTERN.

Mr. John Q. Simonson, of Graniteville, Staten Island, is the inventor of the improved filtering cistern illustrated in the accompanying engraving.

He claims, as the advantage secured by his invention, that by its use, a perfect substitute for wells is obtained at less cost, while supplying purer water.

The filter is a double one, so that the water is really filtered twice before passing into the cistern for use. It has, we are informed, been on trial for more than three years, preventing any dirt or sediment from being deposited in the cistern.



It being an outside attachment, it is easily cleaned out by any ordinary laboring man, and can be quickly re-arranged for use without disturbing the water in the cistern.

The parts, lettered for reference in the engraving, are as follows:

The walls of the cistern are represented at A, the walls of the filter at B, the spout leading from the roof at C, and the exit from the filter to the cistern at D.

Perforated tiles, E, rest upon offsets in the walls of the filter, as shown. The lower tiles are placed sufficiently above the bottom to form chambers, shown separated by a middle partition, these chambers communicating with each other by openings, H. Similar chambers, which do not communicate with each other, are formed above the upper tiles.

The filtering material is placed in the two filtering chambers between the upper and lower tiles, which chambers are also separated by the middle partition.

This filtering material may be one fifth gravel and four fifths charcoal, or it may be all charcoal, or any suitable material preferred.

The flow of the water, as indicated by the arrows, is first into one upper chamber, where it falls upon the perforated tile, which breaks the stream into many small ones, thence it passes slowly down through the filtering material into one of the lower chambers, and from this into the other lower chamber through the openings, H, thence slowly upward through the second filtering chamber into the upper chamber nearest the cistern, out of which it passes into the cistern, purified and ready for use.

In passing slowly through the lower chambers of the filter, the water flows from one to the other through the apertures, H, as described; but as these apertures are at considerable distance from the bottom, there are formed pockets on each side of the middle wall, which serve to collect and retain materials that escape the action of the first filter. The lightest will be retained in the second of these chambers, in which the water ascends with a very slow and gentle movement.

The invention was patented Sept. 10, 1871. For further particulars address Benedict Brothers, 171 Broadway, New York.

The Artificial Volcano.

Dr. Fred. V. Hochstetter furnishes an interesting account of a phenomenon occurring during one of the phases of a manufacturing operation, which is, as he claims, a complete duplicate, upon a miniature scale, of a volcanic eruption, and which serves, at the same time, to confirm the modern views concerning the process of an eruption; according to which the lava is not simply in a molten condition, but is reduced to the state of liquidity by the action of superheated water vapor under great pressure.

The phenomenon referred to occurs in the operation of separating the sulphur from the residual products obtained in the manufacture of soda by Leblanc's process. The sulphur obtained from these residues, in order to free it from the gypsum or sulphate of lime mixed with it, is melted in a suitable apparatus, with steam under a pressure of from 2—3 atmospheres. The

gypsum remains suspended in the water, and the fused sulphur is from time to time run off into wooden troughs or forms, the temperature of the fluid mass being about 123° C. (251.6° F.) Almost instantly after the pouring, a crust of solid sulphur is formed on the surface of the mass. Dotted over this surface, however, the orifices are left, from which the liquid beneath is forced up. At intervals a jet of sulphur bubbles out, and cooling, forms around the orifice a slight prominence; the repeated eruptions accumulate material about it, until a miniature volcanic cone is formed, with its crater well defined.

The cause of this curious phenomenon is found in the fact that the sulphur, in its fused condition in the steam chamber, takes up and retains a certain quantity of water; and this absorbed water, it appears, is given out gradually in the form of steam, as the sulphur solidifies. The slowly liberated steam, accumulating pressure beneath the crust of sulphur, forces, at regular intervals, an outlet at the vents, carrying with it in its passage the molten material to form the solid cone.

QUINNIPIAC DAM.

The town of Wallingford, Conn., by the almost unanimous voice of its voters, has pledged its co-operation with the community of that place, in the erection of a large dam across the Quinnipiac river, in Wallingford. A three hundred horse power will thus be formed, adding materially, it is believed, to the prosperity of the town.

The Wallingford Community is an association comprising about forty-five members, whose religion and social practices are similar to those of the Oneida (N. Y.) Community. At the discussion of the project in town meeting at Wallingford, while all admitted the material benefits to be derived from the establishment of the water power, objection was made to its consummation on moral grounds. It was alleged that the men and women composing the community were simply a parcel of whoremongers and harlots, to associate with whom, in building the dam, would be a disgrace to the town; and it was asked, now that the Government was endeavoring to extirpate polygamy from Utah, why should not Wallingford rather discourage than encourage the existence in their midst of an association of persons like the Wallingford Community?

This view was promptly rejected by the majority, as having no bearing on the subjects in which the town was most interested, namely, the construction of a large dam across the Quinnipiac, and the consequent increase of manufacturing facilities in that vicinity.

The practical difference between the Wallingford, Oneida, Shaker, and other communist associations and the Mormons, appears to be that the latter live in open, flagrant violation of the laws of the land, while the former are law abiding, faithful people, who somehow or other manage to improve and increase the material wealth of the districts around them. But if their private morals are worse than their neighbors, we hope the home missionaries will not neglect them.

GREAT powers and natural gifts do not bring privileges to their possessors so much as they bring duties.

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HINTS TO INVENTORS.

The electro-deposition of metals has attracted the notice of inventors ever since the remarkable discoveries of Jacobi on the subject, and important applications of the knowledge obtained have been made; but there still remains a good deal to be done. Copper plate engravings have been, for a good many years, protected by deposits of hard nickel, but no one seemed to think of extending the application, to other purposes, until quite recently. Nickel plating has now become an important branch of industry, and we are likely to hear much more of its adaptation, to the wants of the arts, the more intimately we become acquainted with it.

There are other metals, which, although they may not promise the same brilliant results as nickel, are, nevertheless, well worthy of careful investigation; and to some of these, we propose to call attention. To begin with, there is manganese, an exceedingly abundant metal, which has been successfully deposited in the form of powder by electrolysis, and has been separated from its amalgamation with mercury, has been reduced at a high temperature, and obtained as a beautiful white metal when alloyed with copper; and yet we practically know nothing about its condition when deposited upon other metals. Some authorities say that the pure metallic manganese tarnishes readily in the air; others say that it is excessively hard, will bear a fine polish, and is not acted upon by ordinary reagents. The probabilities appear to be that it is a permanent metal, of a fine white color when perfectly pure; and, if a method could be found for depositing it in as thin layers as nickel or copper, it would have many valuable applications. Another metal, of still greater abundance, is magnesium. It is only recently that we have been able to prepare and study this metal in large pieces, and we have learned how to manipulate and use it. The next question is, how to decompose its salts in the cold by electrolysis, and plate with it. The metal tarnishes more readily than nickel, and the color is not so fine; but, as it has the remarkable property of throwing down most other metals from solutions, it may be useful as the basis for obtaining these metals for application in the arts. For example, a rod of copper, plated with magnesium, might serve as a method for reclaiming numerous metals from solutions. It is worth trying to find a cheap way of reducing magnesium, as it can be employed for the production of light in photography, and as a reducing agent, and for the preparation of chemical salts. A metal, upon which has been expended much time and research, is aluminum. This metal, as it is usually sold in commerce, is rarely pure, and hence it commonly has a dirty, tarnished appearance. We have seen specimens of it in thin leaves, which presented the white, brilliant appearance of silver, and did not readily tarnish. If aluminum in such purity could be deposited by electrolysis, it could be advantageously employed for many purposes in the arts; how to do this, is the question. It is not worth while for inventors to be discouraged, as it is only a short time since that electroplating was at all understood, and there is easy prospect of our learning much more about it. The three metals, manganese, magnesium and aluminum ought to be more easily obtained, and it is not very creditable to our science that we have not, long since, overcome the difficulty. Silicium, or silicon as it is sometimes called, the base of quartz, is the principal constituent of the crust of the earth. We tread it under foot and discard it in its elementary condition altogether; and yet it has marked properties, that suggest its use for many purposes in the arts. We have seen an alloy of silicium with copper, which no steel file could scratch; and the chemist

who prepared it, said that it could be cast at pleasure, in suitable molds, and he was not certain that it could not be annealed and worked the same as steel. The chloride of silicium can be easily prepared, and this is readily decomposed by sodium, yielding the silicon in pure condition. The chloride can also be reduced by aluminum, in which case the silicon appears in a crystalline form. Perhaps the best way of preparing the crystalline variety is to fuse 5 parts pulverized glass, 10 parts cryolite, and 1 part aluminum, and to wash the resulting slag in hydrochloric acid, and subsequently, in hydrofluoric acid.

Silicium in the form of powder can be obtained by fusing 15 parts silico-fluoride of sodium, 20 parts granulated zinc, and 4 parts of sodium, and washing the slag with hydrochloric and nitric acids. No way of depositing it by the battery has been invented. Silicium, according to our present imperfect knowledge, appears to occur in two conditions, amorphous and crystalline; but these forms are immaterial for our purpose. What we want is the metal, if it may be called a metal, ready for use in alloying with other metals.

The fact that silicium is not soluble in any acids, excepting a mixture of hydrofluoric and nitric acids, at once suggests its use for many chemical purposes.

It is a poor conductor of electricity, an exceedingly combustible substance, even in oxygen gas; and its melting point appears to be between that of iron and steel; but the point of fusion of its alloys, according to the law that obtains on this subject, would doubtless be considerably less. The combination of silicium with magnesium affords an alloy that possesses remarkable chemical properties, and may offer a new compound, to be used as an explosive agent. It is made by fusing 7 parts of the silico-fluoride of sodium, 2.5 parts of chloride of sodium, and 2.5 parts of magnesium, and afterwards washing out the slag in chloride of ammonium. It is a crystalline substance, and, when dissolved in hydrochloric acid, gives off a gas which is spontaneously combustible. If the gas be evolved in a close vessel, where there is oxygen, the combustion ensues with an explosive force, white silicic acid being deposited on the walls of the vessel. It would appear to be well worth while to experiment with a substance of this marked character. It is in the production of alloys that we must look for the chief applications of silicium; and its uses in this direction, are, as yet, very imperfectly understood.

The above are a few of the metals to which we invite the attention of inventors.

MORE ABOUT THE LABOR QUESTION.

The public must become accustomed to see many discussions upon this absorbing question. It is destined to occupy, possibly for many years to come, a prominent place among current topics of newspaper and magazine literature. To those who, as capitalists or as working men, are immediately interested in its permanent settlement upon an equitable basis, as well as to such as make social science a study, it must, until settled, possess interest second to no other likely to be agitated during the present century. Like other social and political questions that involve the welfare of the masses, it has engendered and will yet give birth to bitterness and rancor, and perhaps—though God forbid such an event—to civil and international wars. No human eye can pierce the future; but any intelligent person may read, in the constant growth of the agitation, in the organized marshalling of the two great powers in the conflict, and in the defiant attitude of each, that neither will surrender, until one or the other has obtained a victory, or such mutual concessions and compromises shall have been made as shall bring about the desired adjustment.

At present the attention, of those who have carefully watched the signs of the times, is especially called to the failure, or partial failure, of the courts of arbitration established in England, and from which so much was hoped by Mr. Hughes, their ardent promoter, whose eloquent address at the Cooper Institute, during his visit to this country last November, was quoted and commented upon in this journal at the time.

We also shared the hope that, through these courts, the difficulties and disagreements that have so long burdened the industries of the world would find amicable adjustment, and that their wholesome influence would bring precedents for the establishment of similar courts in other lands. We regret that the result has not justified our hopes. The courts have satisfied neither the capitalist nor the working man, and though they have been the means of retarding crises, they have not been efficient in preventing them.

At the last meeting of the Board of Arbitration and Conciliation for the North of England Iron District, this dissatisfaction was so apparent that Mr. Hughes deemed it necessary to make a long and eloquent address in behalf of the continuance of the system, admitting that its value had been seriously called in question, and that the method is charged with being both expensive and unsatisfactory.

In the course of his argument, that gentleman admitted that neither the workmen nor the iron masters would abandon their organizations, but thought that their being brought "face to face from time to time" was not without sufficient advantage to pay for its cost. This is a virtual admission that the system has failed to meet the purpose for which it was originated, and it is not probable that it will long continue.

We need not allude to special decisions and awards that have dissatisfied both employers and employed. It is enough that the dissatisfaction exists, even under the administration of such single minded and true philanthropism as that of Mr. Hughes and Mr. Mundella. Possibly there are features

of the system, that, modified or abolished, would render it more acceptable, and we sincerely wish this may be found to be the case; for if, in such deliberations as have been held under this system, the differences have been seen to be so great that peaceable arbitration is not possible, what will the end be?

The persistent blindness of many to the magnitude of this labor question is a prominent feature of journalism. There are those who either ridicule, or treat in a jocose manner, events which are of the gravest importance, while others seem to think everything will all come out right, without social revolutions; or, if the latter occur, that they are far distant. Others see that there are contingencies that may bring about a labor crisis at any moment, and who raise the voice of warning.

To prove that the demands of the trades' unions are arbitrary and unjust amounts to nothing. They have found themselves in a position to enforce compliance with unreasonable demands. Though only a few of their leaders and comparatively few of those who oppose them realize it, they are making war against the wages system. They will drive capital so hard as to either compel it to withdraw from industrial enterprises or admit the employed into partnership. The wages system, as it exists, will ultimately be compelled to yield to another, if not a better, order of things.

Mr. William Taylor, at the Congress of the British Association, stated that out of 22,704,108 people in England, 8,144,000 do the work, and that they earn in the aggregate 267,000,000 pounds sterling, which, allowing them to work constantly six days per week, is equivalent to an average wages of twenty-one pence per day. A workman takes Mr. Taylor's figures as his text, and shows that the cost for food, of bread, meat, and potatoes, with the luxuries of two and a half pence worth of butter, sugar, and tea, sufficient for the sustenance of a workingman, is eleven and one half pence, leaving, according to Mr. Taylor's statement, less than ten pence per day for clothing, shelter, medicine, and all other demands.

We think Mr. Taylor's estimate of average wages must be too small, but allowing the average to be double that given, we have in it matter for serious reflection.

When working men have the intelligence to figure out such a sum as this, and compare their pittance with the unearned wealth of the nobility and State-fed churchmen of Europe, need it be a matter of surprise that they are dissatisfied? How long need we expect them to remain quiet? What can courts of arbitration, that can only feebly affect their earnings one way or the other, do to convince such men that they are justly dealt with by society? That they are unreasonable need not surprise us; that they have been kept under restraint so long is simply because they have been, as yet, a hopeless minority in numbers and intelligence.

The above figures show that in England the part of society known as the working class are only a little more than one third the entire population. The history of the world has shown, however, that to perpetually oppress even a minority requires more than the might of numbers.

On the other hand it may be shown that industrial capital is really hard pushed as well as labor. In a remarkable letter, vouched for in the London *Builder* as coming from a genuine workman, appears the following paragraph relative to the condition of English manufacturers:

"Workmen and their leaders ought to know that, in the industrial race, the manufacturers are already closely run. In iron and cotton producing countries, the people are beginning to work the raw material. Any reader of the *Times* or the statistical abstract can see for himself the steady advance in exports which a few years ago were peculiar to England. Writers in the so called people's paper may ridicule the idea that other countries are making advance in competition with England. But it is a fact which no one can deny, that some engines and other goods have been imported into this country at a much cheaper rate than English manufacturers can produce them."

So it seems both labor and capital are hard pushed to feed and supply luxuries to the drones in the British hive.

Now if capital and labor could make common cause against the drones, instead of fighting each other, their combined efforts would bring about a better state of things, and the result of the present conflict will inevitably be in time a reorganization of society, in which producers and distributors of production will take pre-eminence over those who are at present fed from the public spoon. In the latter class are included all the paupers who live on homely fare in alms houses, those other paupers who wine and dine with liberal salaries in sinecure offices, those thieves who pick pockets in by-ways as well as those who rob the public purse by legislative jobs or fraudulent administration, gamblers in secret hells or public gamblers in gold and stocks, unnecessary middle men who insist upon clutching broad on its way from the producer to the consumer and cutting off their slice from the loaf, in short, all who, without doing anything for the general welfare, make wages low by making the necessities of life dear through their demand upon the productions of the industrious. All these must be turned out to gather their own honey. Then there will be enough for all. Then will eight hours for a day's work, and even less than that, be the rule without special legislation, and strikes will become things of the past.

ANOTHER GREAT PUBLIC WORK.

The almost unknown countries which form the interior of European Russia have been, of late years, rendered accessible by long and well constructed railroads, undertakings which, in an empire to a great extent thinly populated and divided in itself by vast plains, could never have been made but for governmental authority and substantial assistance in

the form of guarantees. The spirited policy of the Czars has been well received by the Russian people, and now a greater and more formidable scheme is announced to the public.

In another column we give the details of the project, as set forth by a valuable European cotemporary. The mountains of the Caucasus bisect the territory which lies between the two seas; and the construction of the contemplated canal will be much simplified by using the river Manitscha, which flows westward into the Sea of Azov, and the river Kooma, Kouma, or Kuma, which flows, in the other direction, into the Caspian Sea. Moreover, a considerable part of the length of the river Manitscha is a long, deep, and wide lake; and these aids to the formation of the canal, reduce the entire distance, 441 miles, to very manageable dimensions. The cost in Russia, where labor is very cheap, is estimated at the moderate figure of \$60,000,000.

M. Blums, the Russian topographer, who presided over the commission mentioned elsewhere, has published, in the *Golos*, a statement that the work will require the services of 33,000 men, to complete it in the specified time, six years.

At present the navigation of the Caspian Sea is left almost entirely to Persian vessels, and the report of the trade on this great inland lake shows that 824 vessels, of a united tonnage of 68,910, entered the harbors in the year 1869.

Plans and details for the prosecution of this work were found in the Imperial archives after the death of Peter the Great, and show how entirely he was convinced of the value, of such a work, to the interests of the great empire which he regarded with a fatherly pride.

The determination and courage of the Czar's government, and the great abilities of Russian engineers, as well as the importance of the work to the material prosperity of the empire, promise a speedy execution of this last great addition to the wonders of the nineteenth century.

THE HASSLER OCEANIC EXPLORATION.

One of the most important expeditions ever fitted out in the United States is now being organized in Charlestown Navy Yard, under the control of the United States Coast Survey, to whose superintendent, Professor Pierce, the credit of originating the idea is due. The *Hassler*, a vessel 165 feet long, well fitted and of ample power, is to convey a corps of scientific men, her officers and crew being selected especially with a view to their fitness for such service. The object of the voyage may be briefly described as the investigation of the greatest depths of the Atlantic and Pacific oceans, of the origin of the deep sea currents, of the varied character of the water as to temperature, weight, and chemical elements, as well as of the fish and other animal life peopling the depths of the sea.

We are informed that the party will proceed first to the South Atlantic Ocean, and afterwards to the West Indies, to discover, if possible, the origin of the Gulf Stream. The next movement will be to ascertain the greatest depth of the Atlantic, and to search out the mysteries of the bottom. Returning to Rio de Janeiro for supplies, the *Hassler* will next proceed to the Atlantic coast of Patagonia, to trace the course of the South Pole currents. Proceeding by way of Magellan's Straits to the Pacific, a similar investigation to that made in the Atlantic will take place; and the ship will then go to San Francisco, where the scientific corps will leave her. She will then be engaged in the survey of the Pacific coast, and afterwards sail to Puget Sound, and perhaps to Alaska.

We look for important discoveries and results from this expedition. The physical features and character of the oceans are little understood, and it is impossible to solve the problems of the currents unless charts of the ocean bottoms, with some approach to accuracy, can be prepared, and some knowledge of the formation of the earth under the waters be obtained. Ocean navigation is now one of the largest industries in the world, and the interests of the commercial, mechanical, and scientific classes are all involved in its prosperity. Precise and detailed information as to the movements of the tides and currents which affect the transit of ocean going vessels has long been looked for, and there seems to be a great probability that it will soon be obtainable.

The scientific members of the party will be led by Professor Agassiz, and the dredging operations will be conducted by the Count de Pourtales. The physical experiments will be under the charge of Dr. Hill, late President of Harvard University; the chemical inquiries will be made by Dr. White, of Philadelphia; and the geological and zoological department is intrusted to Dr. A. Steindacher. Professor Agassiz is in hopes of obtaining a large number of specimens which will add to our information of the fauna and flora of the deep.

The *Hassler* will, in all probability, sail from Charlestown, Mass., on about the 25th of November, and we shall keep our readers informed of her movements and of any discoveries that the distinguished body of scientists may make.

USES OF GLASS IN ARCHITECTURAL DECORATION, ETC

We have been much interested in the inspection of a miniature model of a bed chamber and its furniture, which an ingenious designer and personal friend has fabricated, and the prominent feature of which is the use of glass for decoration. The effects produced are very startling, unique, and beautiful.

The mantelpiece and its brackets are of highly polished and beautifully clear glass, attached to a base of black marble. The cornices are also of glass, the curved parts being of pressed glass, and the parts which are angular in section being ground and polished. The play of prismatic colors is heightened by reflection from the curved portions of the cor-

nice, producing an effect wholly indescribable, but, in our opinion exceedingly beautiful.

The cornice is made in short segments, held at the ends by gilded supports of ornamental design. The walls are papered with delicate lavender with fine stripes of gold, and the upper edge passing under the glass cornice is without other border.

The ceiling has for a center piece a flat oval mirror, with an ornamental gilt frame, and from the center of this frame descends a small gas chandelier proportioned to the size of the model, profusely embellished with prismatic pendants and provided with Lilliputian gas burners. The furniture is of polished black walnut, and is upholstered with lavender colored satin. The floor is furnished with a painted carpet, the colors of which harmonize with the general tone of color throughout the apartment.

The model has convinced us that for interior decoration, where expense is not regarded, a most beautiful effect can be produced on a large scale, as well as in the model, where the ornaments are somewhat out of proportion to the dimensions of the room.

Glass, when of the proper thickness, is scarcely more brittle than marble, and it has the advantage that it can be molded into the proper form, so that the greater cost of the material would be nearly or quite compensated for by the saving of labor.

The hint thus given may prove valuable to decorators, and is, we think, at least worthy of consideration.

A WORD ABOUT REPAIRS.

The inevitable waste and wear which always, in the end, necessitate the abandonment of everything in its day useful to mankind, is compensated for and retarded by repairs. But in the attempt to do this, there is often much time and money uselessly squandered.

One of the principal causes of loss is delay in making timely renovations and substitutions; another is injudicious ways of repairing; and, lastly, repairing that which it were wise to abandon altogether. Instead of at once correcting what is amiss in a tool or a machine, many will let it run as long as it is possible to work with it, when it is often found impracticable ever to make it serviceable again; or, if not so badly injured as this, that one deficiency, which it would have cost little to supply, has caused many worse than the first.

In making repairs it is often thought a poor mechanic will do just as well as better and more costly skill. No greater mistake can be committed. We assert that the mechanical ingenuity, ready command of resources, knowledge of the adaptability of means to ends, skill of eye and hand, common sense, and sound judgment—which go to make up an accomplished mechanic—are more necessary in a repair shop than anywhere else. Here it is not the same old routine, day after day, the making and putting together of forms so familiar as to require little original thought; but every job varies in some particular from every other, and each must be repaired in a different way. It requires brains as well as manual skill to do this kind of work in a creditable manner, and every manufacturer will find it policy to put a first class mechanic in his repair shop.

Lastly, in constantly stopping old machines to patch them up into make-shifts, there is often more money sunk than would supply their places with new ones. Many people estimate the cost of repairs only from the cost of material and labor; but in many cases the time lost in repairing is the largest element of expense, especially when the stoppage of one machine entails the stoppage of many others.

In repairing machines the following rules ought, therefore, to be observed: First. Repair as soon as anything gets out of order. Second. Intrust none but good mechanics with repairs. Third. Be careful not to continue repairs when machines cease to be worth them.

BOOKS FOR MECHANICS.

That sort of egotism which prompts mechanics and inventors to neglect the means of personal improvement and advance in their professions, supplied by books, has prevented many from achieving the measure of success to which their natural endowments entitle them, and is at the present day seriously affecting the condition of mechanics in general. Mechanics, as a rule, read newspapers, stories, and some history, but as a rule they neglect the books replete with technical information touching directly upon their peculiar avocations. They are wont to scoff at the idea of learning an art from books, and to place reliance upon their personal experience, in preference to any knowledge gleaned from the records of others' experience.

Now we do not deny the paramount value of personal experience. That which we have ourselves seen, we know; that which we read may at times mislead us; but when personal experience has been guided and shaped by reading, it must inevitably be more complete, its results better classified, and its value enhanced far beyond that of the knowledge of the man who has only explored his limited field of research without any guide.

A man might in time learn all about the streets, alleys, parks and suburbs of New York by unaided observation, but a well edited guide book would save him nine tenths the labor necessary to accomplish such a task without assistance.

We therefore advocate the use of books by mechanics, not as a substitute for personal experience, although they are in this way often very valuable; but we urge their use principally on the ground that they assist in enlarging and systematizing personal experience and preventing waste of time in the search for facts already discovered.

Every man engaged in any industrial occupation should gather about him a library, even though small, of works relating to his business. Verifying the facts stated in these books by his own experience, or, it may be, discovering that some things stated as facts are errors, cannot fail to enlarge his mind and supply him with practical resources for emergencies, which will not only increase his self respect but increase the pecuniary reward of his efforts. So true is this that we do not recollect a reading mechanic who did not rise in his profession, and who, though perhaps not acquiring fortune, failed to secure the respect always accorded to manifest superiority.

SCIENTIFIC INTELLIGENCE.

HOW TO TEST PURE GLYCERINE.

Thomas Koller gives, in a German journal, the methods for detecting the impurities of glycerin. Pure glycerin is neutral, and leaves only a slight residue when evaporated in a porcelain capsule. The adulterated article may leave considerable black residue, and react acid. Pure glycerin, when cautiously mixed with an equal volume of oil of vitriol, is not browned even after the lapse of several hours; the impure often browns immediately. A solution of oxalate of ammonia does not even produce a cloudiness when mixed with pure glycerin, but may give a precipitate with the impure. Pure glycerin, treated with nitric acid and nitrate of silver, yields no precipitate; sulphide of ammonia sometimes gives a black color in adulterated glycerin. Pure glycerin, in large and small quantity, is as clear as water; impure often shows different shades of color, according to the extent of its contamination. Pure glycerin rubbed between the fingers gives no greasy feeling, while the impure resembles fat. The freezing point of pure glycerin is near zero, while the impure may become solid at the same temperature as water. For the purification of glycerin, add ten pounds of iron filings to every 100 pounds of the impure liquid, and occasionally shake. In a few weeks, a black gelatinous sediment will settle and the supernatant liquid will be perfectly clear, and can be condensed by evaporation.

MALTIN.

A French chemist, Dubrunfaut, described, in 1868, a substance having all the properties of diastase, to which he gave the name maltin. According to his account, it possesses remarkable properties in promoting the fermentation of beer, and it has been strongly recommended in medicine. It is made by precipitating an extract of malt with tannic acid, filtering, washing well, and drying ready for use. Victor Griessmayer, reported in the *Bavarian Brewer's Gazette*, has been repeating some of the experiments of Dubrunfaut, and finds that although the aforesaid maltin possesses some of the properties attributed to it by its discoverer, it cannot be practically employed in brewing. He says: "Maltin is diastase of a decidedly platonic character." From these recent researches it would appear that the noise made about maltin is more in the nature of a trade speculation than of a genuine contribution to science, and that its medicinal character can probably be consigned to the same worthless category as its fermenting property.

"COSMOS."

Victor Meunier announces that *Cosmos*, so long conducted with such signal ability under his editorial management, and suspended during the siege of Paris, is to be discontinued, and in its place he will publish a weekly journal to be called *La France Scientifique*, the subscription price of which is to be ten francs per annum. The well known ability of the editor will ensure to subscribers a full return for the price of subscription.

A NEW ZINC PAINT.

M. Artus, connected with the Belgian Zinc Company, has prepared a zinc white, made up with silicate of potassa or soda and used to paint zinc and other objects. The material is something in the nature of a cement or artificial stone, and will withstand the action of the air, sun, and water. It can be employed to advantage on metal roofing, also on plaster, brick, and wood. Its chief value will be in rendering wood, paper, and tissues unflammable, and for this purpose ought to be generally known. The value of the mixture for cements will also attract attention to it, and we shall probably hear of its extensive use as a constituent of artificial stone. The heat of rooms under roofs painted with this mixture was found to be 10° less than under the unpainted metal.

PRODUCTION OF BISMUTH IN SAXONY.

According to Wagner, it appears that Saxony produces 32,000 pounds of bismuth annually, and, as the yield of this metal in other countries is unimportant, Saxony rules the market of this article. A few years ago the pretended discovery of a method of making gold from bismuth led to the purchase of all there was in the market on the part of a credulous London firm. This produced considerable fluctuation in the price at the time, but as the firm were subsequently glad enough to get rid of their useless purchase at any price, the supply soon became abundant.

OXYGEN FOR PHARMACEUTICAL PURPOSES.

Dr. Baudrimont, in France, has published a lengthy paper on this subject. The author repeats the advice, long given by chemists, to calcine the black oxide of manganese previous to mixing it with the chlorate of potash, and to carefully pulverize the latter before mixing. He finds the proper proportions to be equal weights of these materials, and recommends the precaution of providing as wide tubes as possible, of washing thoroughly, of previously testing the chlorate, and of operating upon small quantities at a time.

A NEW REAGENT FOR COPPER.

The new reagent, proposed by Mr. Tamm, is obtained by

dissolving, in distilled water, equal weights of sulphocyanide of ammonium and bisulphite of ammonia. When this is added to a liquid containing copper, it immediately precipitates white sub-sulphocyanide of copper, as an insoluble powder readily washed; while scarcely any other metal is affected by it. It appears to us that this combination of a sulphocyanide with a sulphite is capable of application in photography and ought to be tried. Its value in separating copper from other metals appears to be well ascertained.

GASES ABSORBED BY COAL.

Ernst von Meyer finds that the gases absorbed by coal are chiefly the following: Carbonic acid, marsh gas, nitrogen, oxygen, and hydrocarbons. He publishes a table with the interesting statement that more nitrogen is retained by coal than any other gas. If it be true that anthracite coal absorbs more nitrogen than oxygen, we have the germ of an important application, as this method could be employed to effect the separation of the nitrogen from the oxygen in the atmosphere, and lead to a cheap way of making oxygen. It may be worth while for some one to repeat the experiments with a view to attaining this desirable result. We give below the table of gases found by Meyer inclosed in coal:

Carbonic acid.....	16.9.....	22.4
Marsh gas.....	20.4.....	22.3
Nitrogen.....	53.3.....	48.0
Oxygen.....	1.7.....	4.1
Heavy hydrocarbons.....	7.7.....	3.2
	100.0	100.0

[Special Correspondence of the Scientific American.]

HOLLY'S SYSTEM OF FIRE PROTECTION AND WATER SUPPLY.

WASHINGTON, D. C., Nov. 11, 1871.

The most severe conflagration that ever occurred in New York city was that of 1835, and \$20,000,000 of property were destroyed. The late fire in Chicago destroyed, it is estimated, \$200,000,000. Lake Michigan and Chicago river encircled the city, but were as impotent to save it as were the exhausted firemen and broken engines. They only environed the awful scene or steamed under the falling cinders.

The property of the Chicago Fire Department cost about \$700,000, of which sum the fire engines and auxiliary apparatus cost about one half. The annual cost of maintaining the department was nearly \$500,000. The water works were admirable of their kind, and cost considerably over \$3,000,000. They embraced the famous tunnel extending far out into the lake, and a large and handsome building within which powerful machinery lifts the abundant waters to the top of a stand pipe 136 feet high. The gravitating pressure of this column of water was relied upon as the power for supplying the ordinary demands of the city through more than 200 miles of street mains, and also to furnish, in case of fire, twenty steam fire engines through a thousand hydrants. Was this the best system of fire suppression Chicago could have had? Might she not have been spared this terrible affliction? Cannot water be concentrated on a burning building so promptly, and in such measure, as to insure the rapid extinguishment of the devouring element, even under the adverse circumstances of high wind and severe cold? These are questions now very anxiously asked.

On a recent visit at Saratoga, I took occasion to examine the new water works of that place, and found the apparatus and general arrangement to be the same as was introduced into Lockport, N. Y., in 1863, Auburn in 1865, and still more recently into thirty cities in ten different states: Buffalo, Binghamton, Dayton, Covington, Minneapolis, Cumberland, Atlanta, etc.

The reservoir at Saratoga is about a mile from the village, and is formed by damming a small but abundant stream; and I learned, to my surprise, that it is several feet below the average level of the main streets. Just below the outlet of the reservoir, and situated on a still lower plane, is the well built and tasteful structure containing the machinery; and a glance at its nature, large proportions, and superior workmanship is sufficient to answer some of the questions of an interested visitor. The whole is known as "Holly's System of Fire Protection and Water Supply," and consists of a series of powerful rotary forcing pumps, worked by turbine wheels below, driven by water from the reservoir, or by a massive steam engine, according as circumstances require. In this case the water power is sufficient during more than half the year. The simplicity of the system is apparent to any observer, and experience has shown its economy and efficiency.

Its leading feature consists in this, that, independently of what is called a "gravitation supply," whether from an elevated reservoir, or a stand pipe constantly filled from a source on a lower plane, the mains of a city can be supplied with water in exact proportion to the demand; and in case of a conflagration, a power of propulsion can be given far exceeding in steadiness and degree that attained by any other means. By combining, with pumps so admirably constructed and arranged, a hydrostatic pressure regulator, the whole is placed under such perfect control that in twenty seconds the pressure can be increased from the ordinary measure, say sixty pounds to the square inch, to double that amount, or even triple, if required.

A telegraph line connects the works with the headquarters of the fire department in the town; but aside from this communication, a most delicate and automatic one exists in the apparatus itself, for the opening of a single hydrant in the most remote street is instantaneously indicated by the regulator, causing, at the same time, a bell to ring for the information of the engineer. Just after the works were completed in July last, a fire broke out in a hotel situated between the Union and the Clarendon, seriously threatening both;

and about the same time another fire started, several blocks distant, among very combustible buildings and material. The village itself was in great danger, and, when both fires were speedily brought under control, the citizens were of the opinion that the works had, on that one occasion, saved the entire cost, and that the three steam fire engines heretofore depended on could not have been equal to such an emergency.

The following are the more evident advantages of the Holly system:

1. Dispensing with all locomotive fire engines.
2. A gravitation supply not needed, nor even an artificial reservoir, where a lake or river is at hand. At Binghamton the water is drawn directly from the Susquehanna, and at Cumberland, Md., from the Potomac.
3. The water is applied to a fire much more speedily than in any other way, or as soon as a hose can be attached to a hydrant.
4. The water is thrown more rapidly, and from one fourth to one third greater distance than by a steam fire engine; and the stream is steady and not exposed to irregularities and failures from the effect of extreme cold or defective machines.
5. Every building can have within it an effective extinguisher, and every private hydrant and water cock becomes a fire engine, effective in proportion to its size.
6. The propulsion is so great that long hose can be used, even half a mile, with entire success.
7. The great reduction of insurance rates—twenty-five and even fifty per cent in some cases.

Mr. Holly has devoted himself for years to devising improvements in the construction of pumps and their application to fire prevention. The records of the Patent Office show at least ten patents issued to him, one as early as 1849. Wherever adopted, the system has proved valuable and effective.

Replaceable Pivots for Watches.

When, heretofore, watch pivots have broken from their stems or spikes, it has been customary to bore into the remaining end of the spindle and insert a new pivot into the socket thus prepared. The boring of the very small spindles is a matter of difficulty, requiring delicate handling. It often happens that the spindles or axles break out while being bored, or that the boring tools break off during the operation and remain in the spindles, thus making the latter useless. When this occurs, it is necessary first to soften the spindles for boring, and then reharden them, thus adding still more to the cost and difficulty of repair.

The invention of Mr. Simon B. Simon, of New York, consists in the production of repair pivots, having tubular sockets, so that they may be slipped upon the ends of the spindles or stems when required, thus dispensing with the necessity of boring the spindles.

Electric Pyrometer.

A most ingenious and valuable application of the known fact that the resistance of metals, to the galvanic current, increases directly as the temperature, has lately been devised in Germany. The resistance of a platinum wire having been determined, a cylinder of clay is surrounded with such wire, and covered with a tube of the same earth. The coil is connected with a two cell Daniell's battery, and also with an indicator for the determination of the resistance, and subjected to the heat of which a test is required. Such an instrument would be valuable in temperatures at which mercury would evaporate and glass melt.

HOW TO ACQUIRE A GOOD MEMORY.—We read too much and think about what we read too little; the consequence is that most of the people we meet know something, in a superficial way, about almost everything. Not a tenth part of what is read is remembered for a month after the book or newspaper is laid aside. Daniel Webster, who had a rich store of information on almost every subject of general interest, said that it had been his habit for years to reflect for a short time on whatever he read, and so fix the thoughts and ideas worth remembering in his mind. Any one who does this will be surprised to find how retentive his memory will become, or how long after reading an interesting article, the best portions of it will remain with him.

As daylight can be seen through very small holes, so little things will illustrate a person's character.

Inventions Patented in England by Americans.

From October 19 to October 30, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

ANIMAL TRAP.—W. H. Chase (of New York city), London, England.
HARVESTER.—W. F. Goodwin, Metuchen, N. J.
ORDNANCE.—N. Thompson, Brooklyn, N. Y.
PAPER BOX MACHINERY.—H. R. Heyl, Philadelphia, Pa.
PHOTOGRAPHIC PICTURES.—F. A. Wenderoth, Philadelphia, Pa.
PISTON, ETC.—S. L. Wiegand, Philadelphia, Pa.
PRESERVING WOOD.—N. B. Thomas, New Orleans, La.
ROYAL FRAME.—E. P. Morgan, J. H. McMullen, York, Me.
SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, England.
STEAM PACKING.—G. M. Craikshank, W. R. Smith, Providence, R. I.
TRANSMITTING POWER.—W. F. Goodwin, Metuchen, N. J.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & CO., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Lubricating Oils of Chard & Howe, 134 Maiden Lane, neither gun nor chill.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$1 00 a year. Advertisements 17c. a line.

Vertical Engines—Simple, Durable, Compact. Excel in economy of fuel and repair. All sizes made by the Greenleaf Machine Works Indianapolis, Ind. Send for cuts and price list.

Metallic Molding Letters, for Pattern Makers to put on patterns of Castings, all sizes, etc. H. W. Knight, Seneca Falls, N. Y.

Wanted—A competent man to take charge of a Screw department as Foreman. A good steady man can have constant employment. Address Bles Sewing Machine Co., 89 John St., Brooklyn, N. Y.

The Pew Hat Rack. State and County Rights. E. S. Blake, Pittsburgh, Pa.

The best wood filler in use, 25 cents per lb. Made, used, and sent (in packages of not less than 16 lbs.) all over the country, C. O. D., by L. W. Jones, Unionville, Conn.

The best and cheapest Self Oilers are manufactured by Holland & Cody, 8 Gold Street, New York. Send for price list.

Hafner's Patent Eureka Coil Spring for Mill Spindles, is the only Spring constructed on scientific and the rotary principle. Mill-furnishers, millwrights, and millers, send for circulars and satisfy yourselves. Sample spring sent on trial to reliable parties. John A. Hafner, Santa Fe, Ill.

Land sufficient for the purposes of any good manufacturing business, and most admirably located on the Poughkeepsie & Eastern R. R., with plenty of water for steam purposes at hand, and only fifteen minutes' walk from the center of the city, will be given to any parties who meet the views of the owner. Address P. O. Box 534, Poughkeepsie, N. Y.

Tested Machinery Oils—Kelley's Patent Sperm Oil, \$1 gallon; Engine Oil, 75 cts.; Filtered Rock Lubricating Oil, 75 cts. Send for certificates. 116 Maiden Lane, N. Y.

Use Soluble Glass for fireproofing Wooden Pavements, Shanties, R. R. Bridges—also as common hardening Mortar and Cements, makes most durable Stove and Foundry Putty, Iron Cement. Apply to L. & J. W. Feuchtwanger, Chemists, 35 Cedar street, New York.

Francis Schleicher, Consulting, Analytical and Manufacturing Chemist, Laboratory, Newark St., between Jackson and Harrison St. P. O. Box 172, Hoboken, N. J.

One "Scott's Wheel Moulding Machine," saves \$5,000 yearly in patterns—wheels absolutely perfect. Engraving sent free. Hamilton E. Towle, 156 Broadway, New York.

Portable Farm Engines, new and beautiful design, mounted on Springs. Compact, light, and efficient. Send for descriptive circular, Mansfield Machine Works, Mansfield, Ohio.

For the best 15 inch Eng. Lathes, Bench Lathes, or Friction Pulleys, address John R. Abbe, P. O. Box 345, Providence, R. I.

Kelley's Chemical Metallic Paints, \$1, \$1.50, \$2 per gallon mixed ready for use. Send for cards of colors, &c., 116 Maiden Lane, N. Y. I want the address of every cabinet maker and every painter in the world. J. Henry Symonds, P. O. Box 57, Boston, Mass.

Stencil Tools & Steel Letters. J. C. Hilton, 66 W. Lake st. Chicago.

To Boiler Makers—Water Gauges sold cheaper by us than any other House in the Country. Holland & Cody, No. 8 Gold st., N. Y.

Baxter's Adjustable Wrenches fit peculiar corners where no other will work. All first class mechanics need one. Baxter Wrench Co., 18 Park Place, New York.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Shoe Peg Machinery. Address A. Gauntt, Chagrin Fall, Ohio.

We will remove and prevent Scale in any Steam Boiler, or make no charge. Geo. W. Lord, 107 Girard ave., Philadelphia, Pa.

Builder's Scaffold—Patent for Sale—For further particulars, address Redick & Knutle, Butler, O.

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

Walrus Leather, for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

Kelley's Pat. Petroleum Linseed Oil, 50c. gal., 116 Maiden Lane

Turkey Boxwood pieces for Sale, suitable for engravers and tancy turners' use. Address Stephens & Co., Riverton, Conn.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

The best lubricating oil in the world is Winter pressed Sperm. Sold in bottles, cans, and barrels, by Wm. F. Nye, New Bedford, Mass.

Vinegar—how made—of Cider, Wine, or Sorgo, in 10 hours F. Sage, Cromwell, Conn.

Best Oak Tanned Leather and Vulcanized Rubber Belting. Greene, Tweed & Co., 18 Park Place, New York.

To Cotton Pressers, Storage Men, and Freighters.—35-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 35 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water st., New York.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water st., N. Y. Presses, Dies, and Tanners' Tools. Conner & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

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

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

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. B. Baldwin, Lacosta, N. H.

Blake's Belt Studs. The cheapest and best fastening for Rubber and Leather Belting. Greene, Tweed & Co., 18 Park Place, N. Y.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th 1869. Also, Glatier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

15 horse power Engine and Boiler, complete, for sale cheap. R. H. Norris, near West Street Bridge, Paterson, N. J.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms \$4.00 a year.

Examples for the Ladies.

A Cady, of Cambridge, Mass., has used her Wheeler & Wilson Machine constantly in all kinds of dress-making, since the spring of 1868, without repairs, and it is now as good as new.

Burnett's Cocaine for the hair takes precedence all over the United States.

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 100a line, under the head of "Business and Personal."

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

D. F. C., of N. J.—There have been no less than eleven patents taken on nickel plating.

J. M., of —.—Inquire of your bookseller, or write to Baird, Philadelphia, for Box's "Practical Hydraulics." It contains all necessary tables and formulae for the solution of most practical problems in hydraulics.

W. W. M., of —.—Your query is not sufficiently intelligible.

E. C. B., of Wis.—To increase the capacity of an engine, beyond the capacity of the boiler, gives rise to loss through increased radiation and friction, owing to increased surface and weight of parts.

A. B. B., of Thames, N. Z.—We have no information relative to the use of rubber springs, for storing power, for the propulsion of street cars, etc., that we have not already published.

G. S. A., of Ind.—A fly wheel is an accumulator and distributor of power and a regulator of expenditure, not a creator, of power.

E. K. J., of Mich.—The only way to positively determine the initial pressure in the cylinder of your engine is to use the steam engine indicator. It is useless for us to guess at it for you, with only one element of information, namely, distance of cylinder from boiler.

J. W. G., of —.—To restore horseshoe magnets that have lost their power from disuse, proceed as with new ones. Place the poles of the magnet to be charged, against the poles of another, making opposite poles meet. Then draw a piece of soft iron, placed at right angles upon the magnet to be charged, from the poles to the bend. Do this a number of times on each side of the magnet. If the magnet is of good steel, this produces a maximum power. It is the method of Jacobi, and is considered one of the best.

W. G., of Pa.—We do not think tannate of soda is an article of general commerce as yet, though if it is as effective in scaling boilers as stated by a former correspondent, it must inevitably become in great demand. It may be formed by slowly adding a solution of tannin to a solution of caustic soda.

A. P., of Cal.—Ewbank puts his steam current outside of the vacuum nozzle, which requires steam in large quantity to get the exhaust. Professor Draper puts the steam nozzle inside of the vacuum tube, which requires far less steam.

DAMAGED MIRROR.—Pour upon a sheet of tinfoil about three drams of quicksilver to the square foot of foil. Rub smartly with a piece of buckskin until the foil becomes brilliant. Lay the glass upon a flat table, face downwards; place the foil upon the damaged portion of the glass; lay a sheet of paper over the foil, and place upon it a block of wood or a piece of marble with a perfectly flat surface; place upon it sufficient weight to press it down tight; let it remain in this position a few hours. The foil will adhere to the glass.—C. T., of Vt.

H. B., of Pa., writes, in regard to an answer on hydraulic and steam pressure, Vol. XXV., page 281, that they are equal in effect on boilers. "I have always thought from what I have seen in testing boilers that water had greater effect than steam; as I have seen them leak under test, and have steam to same number of pounds, and no perceptible leak. I supposed it was because water was denser and the boiler was tight from not having the iron warm. I have two more subjects which have caused me some thought: Is not the bottom of the boiler more strained than the top, in proportion of the weight of water over steam?" . . . To the first we reply that the effects described as occurring with boilers under water pressure do not indicate greater strain, and are accounted for by our correspondent's correct view. To the second query we answer in the affirmative. The third query is not intelligible.

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.—**TINNING SHEET IRON.**—I wish to know how tinning upon sheet iron is done, and how much it costs per pound.—G. H.

2.—**WATER WHEEL POWER.**—Will you please inform me how large a pipe it will require to supply a 20 feet overshot water wheel with sufficient water to run one run of three feet six inches and one run of two feet six inches burrs, with bolt, smutter, and two elevators. I can run the whole thing now with forty pounds steam, (boiler 18 feet by 3 feet 6 inches; engine 10 by 18 inches).—W. G. D.

3.—**BALLOONS.**—What is the lightest and toughest material or small balloons?—J. H. B.

4.—**INCORUSTATION IN BOILERS.**—I noticed in a recent number of your paper that the tannate of soda has been successfully used to prevent incrustation in boilers. Please inform me how much is required for a locomotive boiler 18 feet long, 40 inches diameter, with 120 two inch flues and how often it should be used.—J. H. W.

5.—**SPRING IN SHAFTING.**—Will shafting that has been heated and bent, and afterwards straightened and turned up, be likely to spring at the place where it was bent?—J. M. G.

6.—**WORMS IN HICKORY.**—I am engaged in a business in which a good deal of green hickory wood is used, and would feel obliged if any one can tell me of a simple preventive of worms, which often render it useless.—S. F.

7.—**CUTTING BEVELS.**—Can any of your readers give me a rule for cutting miter corners on beveled work? I am working in a wagon shop, and often want to cut a miter corner on a seat or body, where the corners are square, but the sides and ends, or some of them, are beveled. I have to go by the old cut and try rule, and a rule for cutting them would be of great service to me.—C. H. S.

8.—**FACING FOR SAND MOLDS.**—What can I use to dust over the surface or green sand molds to prevent the sand from burning, so as to produce clean bright castings? Should I use a flux in the process of melting?—W. Z. M.

9.—**CEMENT FOR LEATHER.**—How can I make a cement or glue, for joining leather, that shall be waterproof, strong, and not expensive?—G.

10.—**PULVERIZATION OF GELATINE.**—Can any of your readers tell me how to pulverize French gelatine to the fineness of flour?—H. M. C.

11.—**PAINT FOR OUTSIDE WORK.**—Will some of your correspondents give a recipe for an economical and durable wash or paint for outside work? Neutral color desired.—C. H. M.

12.—**PRESSURE ON SLIDE VALVES.**—In a steam engine, with flat slide valve, what proportion of the steam pressure, unbalanced and tending to produce friction, is there on the solid ends of the valve when sliding on the seat and not over the ports? How much is the pressure on the back counterbalanced by the steam between the valve face and the seat, without regard to ports or openings? What proportion of the weight of a steam engine, with flat slide valve, including steam pressure on its back, is required to move it, weight being applied direct?—P. A.

13.—**PROPORTION OF KEY WAYS.**—Please inform me if there is any rule laid down for the different sizes of key ways in shafts and wheels; and, if so, where I can procure it.—T. H. B.

14.—**SPEED OF STEAM ENGINE.**—Suppose that a steam engine has a cylinder 12x18 inches, with ports 1x10 inches, and is making 120 revolutions per minute, being very heavily loaded. Would it be better to give the engine more speed and enlarge the pulley driven by the engine, running the machinery as before? Would there be as much strain on the engine, and would there be much more friction on the slides, wristpin, and main journals, the work done by the engine being the same in both cases? The boiler that furnishes this engine with steam is a locomotive boiler with 357 square feet of heating surface.—E. F.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ARE ALL PLANETS INHABITED?—C. M.

CHEMICAL FIRE ENGINE.—H.

PSYCHIC FORCE.—C. E. S.—J. S.—H. G.

WOOLEN MANUFACTURE.—S. S.

ANSWERS TO CORRESPONDENTS.—R. F. H.—S. C.—S. P.—

T. A. R.—T. W.—W. G. E. H.

QUERIES.—E. N. S.—H. M.—J. W.—P. B.—R. F. H.—W.—

W. W. M.

Recent American and Foreign Patents.

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

SCREWING BOLTS INTO BOILERS.—Allan Talbott, Richmond, Va.—The object in this case is to prevent leakage of water or steam from boilers by reason of the rusting of the plate bolts or from their becoming loose in consequence of strains put upon them in various ways. The desired end is attained by means of bushings or thimbles which have solid bottoms and are inserted in the bolt holes to receive the bolts.

PROCESS OF WELDING COPPER.—Christian L. Schurt and William G. Rehbein, Baltimore, Md.—This invention relates to a process whereby copper may be welded so as to produce as perfect a union between the surfaces in contact as can be produced in iron, a thing which has heretofore been deemed impossible.

ORE CRUSHING MACHINE.—Samuel Hughes, Charleston, S. C.—This invention relates to a metal shell lined with crushing ribs, and combined with an inclosed cone bearing similar crushing ribs on its exterior, the object of the machine being to reduce phosphatic rock to a size suitable for a thorough washing of the same.

ANIMAL TRAP.—Oscar S. Elving, Rome, Tenn.—This invention relates to a trap in which the animal entering steps upon a hinged floor that yields beneath it, which yielding, by means of intermediate mechanism, springs the trap; or, if the floor does not yield, the same result is accomplished by the pulling of the animal on the bait, the trap being provided with teeth which impale the animal, and also cast it out of the trap, so as to leave it in readiness for another.

STEAM GENERATOR.—William Byers, Philadelphia, Pa.—This invention relates to boilers made in separate compartments with fire spaces between them, and it consists in such compartments when constructed with bulged or swelled surfaces between the transverse retaining bolts.

HARVESTER.—John S. Truxell, Greenburgh, Pa.—This invention consists in an arrangement which enables the draft of the team upon a harvester to be regulated in such a manner as to counteract the resistance, offered to the sickle bar by the crop, whether the same be little or much.

DESK AND CHAIR COMBINED.—Archibald A. Porter, of Griffin, Ga.—This is an improved school desk or office chair, provided with a desk or writing board, so constructed that the said desk or writing board may be conveniently turned back out of the way.

BLASTING PLUG.—Julius H. Holsey, of Butler, Ga.—This is a new implement, to be inserted, previous to blasting, in the holes drilled into wood or rock, and is to receive the explosive charge, with the object of insuring greater safety in the preparation of the charge and more perfect results of blasting, without danger to the attendants. The invention consists in the use of a hollow pin, of wood, metal, or other material, made in two sections, to receive the charge and control its force.

BELL PIANO.—Carl G. G. Buttkeleit, of Toledo, Iowa.—This invention consists in actuating bell hammers for musical instruments. To effect the desired result a combination of keys, dampers, toggles, and springs is employed, the details not being susceptible of verbal description, but involving only well tested and efficient elements of mechanism.

SELF HEATING SADDLE IRON.—Joseph Melder, of Munchen, Bavaria.—This is a self heating saddle iron, so constructed that it will consume all the products of combustion before the same can escape, thereby avoiding inconvenience from smoke and gas. The invention consists in the application to the heater of plates and wire gauzes, which, when heated by the fire, will serve to consume the products of combustion. The invention consists also in the arrangement of receptacles for heating crimping and curling irons, the said irons being either removable or adjustable.

CLOTHES DRYER.—Hiram Knight, of Westminster, Mass.—This is a new construction of clothes dryer, so made as to be self supporting in every position without requiring hangers or locks, and which can be folded together into a narrow space.

PROPULSION OF VESSELS.—John P. Bruce, of Brooklyn, N. Y.—This invention relates to a new mode of propelling marine vessels; and consists in driving the screw or propelling wheel by means of water wheels revolved or driven by water elevated by pumps, the latter being driven by a steam engine, the whole arranged in the specification with reference to accompanying drawings, without which the details cannot well be explained.

FORGE.—Joseph R. Morris, Houston, Harris Co., Texas.—This invention relates to an apparatus in which the gases from one or more forges, instead of passing off unconsumed, into the atmosphere, enter a furnace and are burnt therein, thereby furnishing heat for the generation of steam in a boiler connected with said furnace, which steam is used to drive a fan, that impels a blast into each forge, and is also used to propel an engine that operates a hammer; the exhaust from the engine being conducted to the tweers of the forges through pipes, in which are placed red hot iron plates, which decompose the steam, taking up the oxygen and liberating the hydrogen that is burnt in the forges.

MACHINE FOR MAKING PAYING BLOCKS.—Samuel Wallace Brooks, of Brownsville, Texas.—The cutting knife of this machine is hexagonal, or of any other form desired, and, being actuated by suitable mechanism, the wood, which has been previously sawn into proper lengths, is forced, by a weight, down, edwise upon the grain, upon the knife, which thus shapes the blocks. It is claimed that wood paying blocks may thus be rapidly and perfectly prepared.

MACHINE FOR SAWING SPOKES.—Thomas J. Tolan, of Delphos, Ohio.—This is a combination of a rotary saw, with two disks and a spring, together with other peculiarities in the machine, whereby spokes may be sawn from bolts, which is claimed to possess advantages over other machines hitherto used for this purpose.

IMPROVEMENT IN PLANING MACHINES.—Charles E. McBeth, Frederick Bentele and William C. Margendant, of Hamilton, Ohio, and Henry Cramer, of Muscatine, Iowa. The reader is referred to page 225, current volume of the SCIENTIFIC AMERICAN, for a full description, with engravings, of this machine.

CORN PLANTER.—Abraham H. Stark and John C. Mitchell, of Nevada Iowa.—This is an improved self dropping, check row corn planter, consisting of a combination of a hopper having a single hole in its bottom; a measure of the quantity of grain to be planted; a case, arranged thereunder, having two holes and a slot in the top, and having one central discharge hole in bottom; with plates, rigidly connected, movable together, and having two holes apiece therein; and the tubes extending not quite to bottom of case. Also, a combination with an adjustable shoe, clamp and arm to fasten the said shoe detachably to the frame of the planter and the runner thereof.

PIPE WRENCH ATTACHMENT FOR MONKEY WRENCH.—A. H. Woodruff, of Lansing, Iowa.—This invention consists in a wedge shaped block of steel with teeth upon its inclined face, which is placed upon the movable jaw of a monkey wrench, and which has on each side a spring catch, which engages with the shank of the wrench when the block is in position. The teeth of the block will, when thus adjusted, engage with a pipe or rod so that the latter can be turned as desired.

SULKY CULTIVATOR.—Philip Hewitt, of Farmland, Ind.—The nature of this improvement precludes an explanation of details. The object sought is to render this class of cultivators more effective and convenient in use, and to this end the inventor, while using many well known devices, adds features formed of spiral wire cords attached to plates on the inside of the cultivator plows, to protect the plants, and a peculiar construction of frame with its seat and levers, to render all parts of the machine easily adjustable and controllable by the operator.

HARVESTER.—George S. Grier, of Milford, Del.—This is an attachment of a studded carrier to the self raking apparatus of harvesters, with a gear shifting bar, so constructed that the carrier may be automatically thrown out of gear with its actuating mechanism, and thrown into gear by the driver, the design being to so improve the self raking attachment that its action may correspond to the varying quantity of grain in different parts of a field, and that the gavel may be made of nearly uniform size.

HORSE HAY FORK.—Charles A. Howard, Pontiac, Mich.—One part of the fork has two curved tines, the other part has only one curved tine. These parts are pivoted together and are further connected by bars, which are crossed and pivoted to the shanks of the two divisions of the fork. To these bars or links is attached a tripping device, which by pulling a cord releases the parts so that they open and discharge their load. We judge this to be a convenient improvement, and it certainly is simple, strong, and durable.

HAND SUPPORT AND ADVERTISING MEDIUM FOR STREET CARS.—Mahlon Warne, of Philadelphia, Pa. has invented an improved support and advertising medium for railway cars. A circular frame is composed of two similarly constructed parts, each provided with a groove, so that, when put together, they form a hollow ring for the reception of an endless cord on which is placed a round wooden bar or handle. The cord is tightly clamped between the circular sections by means of screws, but the handle slides freely thereon. The upper ear is slotted to admit of the attachment of a strap, whereby the device is secured to the roof rails of a car. Each of the sections of the frame is cast with an inner flange or rabbetted edge, whereby, when put together, a recess or annular groove is formed, suitable for the reception of circular plates of glass. Between these plates it is designed to place advertising cards, prints, or pictures. Thus, the prints while protected will be legible through the glass, and similar or different advertisements may be placed in the same frame, which, from the position of the frame in the car, it is manifest cannot fail of quickly attracting the notice of passengers. The support is free from a tendency or liability to cramp the hand of the person grasping it, adapted to conceal the junction of the ends of the cord, as well as tightly clamp the same, and is also a device calculated to adorn the car in which it is suspended, while incidentally constituting a most efficient means of displaying advertisements.

COMBINED DINNER PAIL AND LANTERN.—This invention relates to a new dinner pail which is provided with a lamp whereby its contents can be heated, and with a transparent side or door through which the rays of light from the lamp can be projected. Horace C. Ketcham and Willie W. Ketcham, of Newark, N. J., are the inventors.

HARNESS BUCKLE.—Othnel Brown, of Albion, Iowa.—This invention relates generally to harness buckles, but particularly to that patented December 21, 1868, by O. B. Smith. The cross bar of the frame of the buckle has a stud pin rising vertically from it to enter the hole of the strap to be buckled, which is passed under one cross bar and over another. A clamping bar or lever is pivoted in ears rising from the side bars of the frame, and bearing at the short end on the strap around the pin, a hole being made in the short end for the pin. The long arm is bent inward, so as to bear against the strap inside of the main frame and close to one of the cross bars in such a manner that the straightening of the strap by the tension of the draft will force the long arm of the lever out and the short one in, in a way to hold the strap more firmly, according to the strain.

TWINE CUTTER.—Charles Carrington Lewis, of Gainesville, Ala.—This is a new, simple implement to be used in stores, warehouses, etc., for the purpose of cutting twine and cords used for the tying of packages. The invention consists chiefly in applying the cutter to a pivoted balance weight, which is connected with a sliding bed on which the twine is cut. The bed is drawn in during the cutting process and moved out subsequently to bring the end of the twine or cord within convenient reach for future use. A spring holds the twine in contact with the movable bed.

LIGHTNING ROD COUPLINGS.—David W. Demorest, of Newark, N. J.—This is an arrangement of a lap and lock splice on the sections of rod, whereby the same are not only jointed but actually locked together. The invention consists, also, in the application of a screw to the coupling or bearing for locking one of the sections to the coupling, and thereby furnishing an absolute support.

CIGAR LIGHTER.—Joel B. Miller, of Rondout, N. Y.—This is a new pendant cigar lighter, similar to those now used in cigar stores, but so arranged that it will produce the flame by the consumption of kerosene or other burning fluid, instead of gas. The invention consists chiefly in so hanging the pendant burner and reservoir to a frame or arm that, by vibrating the former on its pivot, the wick will be shifted to give a greater or less flame as may be required.

WATER WHEEL.—Samuel D. Taylor, of Hazleton, Pa.—An improved mode of applying gates to turbine wheels; the effects of which are, first, to enable the gate to work close to the wheel, and thereby to bring the unchecked velocity of the water to bear upon the buckets as soon as it passes the throats; secondly, to admit of adjustment without changing the course of the water to the wheel. These effects are produced by means of a series of movable plates, and are extensions of stationary chutes, combined concentrically and closely with the wheel and each other, so that the course of the water will not be changed (as where the chutes move) nor the velocity impeded, after passing the throats, by an adjustment of the gates.

BARK MILL.—Owen Coogan, of Pittsfield, Mass.—This is an improved machine for reducing or breaking up bark for tanners' use, whether the same be in a dry, damp, or green state. This invention consists in the arrangement of a hinged adjustable leaf with the feeding table and roll, and in the method or means of mounting the feeding roll, by which means the machine can be used for reducing all kinds of bark to a suitable degree of fineness, to best serve the purpose for which it may be intended. The manner of reducing or cutting, will, it is claimed, be quite uniform, and therefore most satisfactory. The feed roller, besides slowly supplying the cutters, serves also to hold the bark, so that it cannot slip or move out of the way when acted upon by the cutters. The cut bark is by the cutters carried off the back end of the table. The cutting-points of the saws or cutters may be of hard metal and removable on their blades, to be replaced when worn.

120,809.—WASHER.—W. Arnold, Pawtucket, R. I.
120,810.—DRYING PAPER, ETC.—H. Dodge, Aibany, N. Y.
120,811.—STOVE.—W. Doyle, Albany, N. Y.
120,812.—VARNISH.—T. J. Elliott, New York city.
120,813.—HORSESHOE.—D. Grim, Pittsburgh, Pa.
120,814.—BANDAGE.—J. G. Grocock, New York city.
120,815.—SEWING MACHINE.—T. J. Harper, Atlanta, Ga.
120,816.—INHALER.—R. B. Heintzelman, New York city.
120,817.—RUFFLER.—E. L. Howard, Malden, Mass.
120,818.—MOP HOLDER.—G. B. Isham, Burlington, Vt.
120,819.—PUMP.—S. W. Kelly, Nashville, Tenn.
120,820.—RIGGING.—J. C. Knowlton, Providence, R. I.
120,821.—BOTTLE STOPPER.—G. C. Lowe, New York city.
120,822.—PADLOCK.—S. Loyd, New York city.
120,823.—CANAL BOAT.—J. M. McMaster, Rochester, N. Y.
120,824.—GAS MACHINE.—W. T. McMillen, Richmond, Ind.
120,825.—STAND.—J. R. Palmenberg, New York city.
120,826.—THRASHER.—A. V. Pitts, Chicago, Ill.
120,827.—AUGER.—R. L. Priester, Souder's Station, Md.
120,828.—GRAIN BINDER.—M. T. Ridout, Sun Prairie, Wis.
120,829.—ROOFING.—J. Siddons, Rochester, N. Y.
120,830.—COBK PULLER.—C. T. Simpers, Philadelphia, Pa.
120,831.—WASH BOARD.—A. D. Smith, Grafton, Ohio.
120,832.—POTATO DIGGER.—J. Smith, Ridgeville, Ohio.
120,833.—CHAIR.—P. M. O., A. S. Snell, Williamsburgh, O.
120,834.—KILN.—D. M. Sporgle, Annapolis, Md.
120,835.—SMOKE STACK.—D. B. Strobe, Fort Wayne, Ind.
120,836.—DITCHER.—F. Taylor, Indianapolis, Ind.
120,837.—ENGINE N. W. Taylor, J. W. Brightman, Cleveland, O.
120,838.—ROLLING METAL.—L. Thomas, Pittsburgh, Pa.
120,839.—ROOT CUTTER, ETC.—G. Trump, Second Fork, Pa.
120,840.—STOVE.—J. W. O. Webb, Cedar Rapids, Iowa.
120,841.—PUMP.—N. W. Wheeler, Morristown, N. J.
120,842.—ORDNANCE.—J. Whitworth, Manchester, England.
120,843.—LET OFF.—A. J. Woodman, Indian Orchard, Mass.
120,844.—HOIST.—W. E. Worthen, New York city.
120,845.—HUB.—E. A. Archibald, Methuen, Mass.
120,846.—PROPELLER.—N. B. Baldwin, Chicago, Ill.
120,847.—WHEEL.—I. E. Bower, Bainbridge, Ga.
120,848.—WASHER.—J. Brower, J. and H. Campbell, West Alexandria, Ohio.
120,849.—DASHER.—W. C. Broyhill, W. D. Sperry, Tremont, Ill.
120,850.—LAYING TILES.—M. A. Burnham, New York city.
120,851.—ROOFING.—O. W. Barritt, Weedsport, N. Y.
120,852.—SHOE, ETC.—F. P. Buzzell, Milton Junction, Wis.
120,853.—WATER METER.—C. Campeaux, New York city.
120,854.—LINK JOINT.—C. B. Carpenter, North Attleborough, Ms.
120,855.—SEWING MACHINE.—W. Chicken, E. S. Moulton, Chelsea, Mass.
120,856.—GOVERNOR.—G. W. Clark, Council Bluffs, Iowa.
120,857.—APPLE CORER.—S. C. Collins, Oregon, Mo.
120,858.—BEE HIVE.—T. S. Collins, H. Senseman, Tremont, O.
120,859.—EVAPORATOR.—J. Cook, Wellsville, N. Y.
120,860.—BRIDLE BIT.—H. M. Cornell, Brighton, Ill.
120,861.—REIN.—J. P. Crutcher, T. Y. Vancleave, Cornersville Tenn.
120,862.—GUNPOWDER.—C. W. Curtis, London, England.
120,863.—CHUCK.—A. F. Cushman, Hartford, Conn.
120,864.—JACK.—A. A. Davis, Clark's Green, Pa.
120,865.—BED.—J. M. Farnham, Hartford, Conn.
120,866.—FIBER.—J. Felber, St. Louis, Mo.
120,867.—REFRIGERATOR.—J. W. Fisher, Islip, N. Y.
120,868.—HEMMER.—D. Forest, Eastport, Me.
120,869.—SAD IRON.—E. A. Franklin, Brenham, Tex.

120,870.—ASH PAN.—J. Gates, Portland, Oreg.
 120,871.—IRON.—L. S. Goodrich, Waverly, Tenn.
 120,872.—STOOL, ETC.—G. W. Griswold, Factoryville, Pa.
 120,873.—HARROW.—E. S. Herrington, Emmett, O.
 120,874.—SAFE.—E. Holmes, Brooklyn, N. Y., H. C. Roome, Jersey City, N. J.
 120,875.—CURTAIN.—E. Holmes, Brooklyn, N. Y., H. C. Roome, Jersey City, N. J.
 120,876.—HOG RING.—W. S. Houston, Mansfield, O.
 120,877.—ANIMAL TRAP.—N. S. Howell, Tualatin, Oreg.
 120,878.—VALVE.—D. W. Huntington, W. A. Hempstead, South Coventry, Conn.
 120,879.—COMPOUND.—A. M. Irwin, Brooklyn, N. Y.
 120,880.—STAND.—W. C. James, Fishersville, N. H.
 120,881.—BED.—J. Johnson, Hartford, Conn.
 120,882.—GAS BURNER.—W. Jones, Chelsea, Mass.
 120,883.—MOVEMENT.—W. F. Jones, Easton, Kansas.
 120,884.—INSULATOR.—G. W. Kidwell, Elwood, Ind.
 120,885.—HONEY BOX.—E. C. Lewis, Glasgow, Mo.
 120,886.—DISH WASHER.—M. E. Lewis, Mansfield, O.
 120,887.—SEWING MACHINES.—W. H. Lewitt, St. Louis, Mo.
 120,888.—PISTON.—H. P. McCerrell, Pittsburgh, Pa.
 120,889.—MATCH BOX.—L. O. P. Meyer, Newtown, Conn.
 120,890.—MATCH HOLDER.—L. O. P. Meyer, Newtown, Conn.
 120,891.—MATCH HOLDER.—L. O. P. Meyer, Newtown, Conn.
 120,892.—MATCH CASE.—L. O. P. Meyer, Newtown, Conn.
 120,893.—BEDSTEAD.—T. W. Moore, New York city.
 120,894.—BOILER.—J. Murdock, South Carver, Mass.
 120,895.—FORCING LIQUIDS.—M. E. Ogden, New York city.
 120,896.—FRAME.—J. S. Pierson, New York city.
 120,897.—FUR BOX.—B. F. Porter, Nashua, N. H.
 120,898.—FIRE KINDLER.—N. Rogers, Thomasville, Ga.
 120,899.—BEE HIVE.—M. R. Sanders, Cambria, Pa.
 120,900.—ROOFING.—R. Sanderson, Cleveland, O.
 120,901.—OVEN.—R. Sanderson, Cleveland, O.
 120,902.—FOUNTAIN.—H. H. Sawtell, Randolph, N. Y.
 120,903.—BOLT.—C. Schneider, Newark, N. J.
 120,904.—BOX.—R. M. Seldis, New York city.
 120,905.—HEATER.—W. Shaw, Albany, N. Y.
 120,906.—FEED BOX.—W. S. Shaw, M. B. Gould, Buffalo, N. Y.
 120,907.—BLACKING BOX.—T. R. Sinclair, New York city.
 120,908.—FILTER.—T. R. Sinclair, New York city.
 120,909.—SHELLER.—A. B. Smith, Wellsburg, W. Va.
 120,910.—PIPE TONG.—J. Stratton, New Haven, Conn.
 120,911.—HARVESTER.—J. S. Truxell, Greensburg, Pa.
 120,912.—AIR REGISTER.—E. A. Tuttle, Brooklyn, N. Y.
 120,913.—BRIDLE BIT.—E. Vanauken, Ludlowville, N. Y.
 120,914.—PAVEMENT.—A. Van Camp, Washington, D. C.
 120,915.—LOCK.—J. F. Vinton, G. A. Hines, Brattleborough, Vt.
 120,916.—WHITE LEAD.—D. Wadsworth, Brooklyn, N. Y.
 120,917.—GRATE.—M. S. Watkins, Memphis, Tenn.
 120,918.—BEE HIVE.—J. Wheelton, Greensburg, Ind.
 120,919.—CHAIR.—O. C. White, Hopkinton, Mass.
 120,920.—BARREL, ETC.—H. Willard, Grand Rapids, Mich.
 120,921.—COOP.—E. J. Wilcox, Ivy Mills, Pa.
 120,922.—BRAKE.—R. J. Wilson, Pittsburgh, Pa.
 120,923.—BOTTLE STOPPER.—W. Wright, Phenicia, N. Y.
 120,924.—BED.—W. Wright, Bloomfield, N. Y.
 120,925.—VALVE.—A. F. Allen, Providence, R. I.
 120,926.—CORN PLANTER.—D. Altman, Nashville, Tenn.
 120,927.—WEIGHT.—H. Andres, Troy, N. Y.
 120,928.—CHURN DASH.—E. J. Ashton, Utica, Ind.
 120,929.—BLOWER.—W. H. Bailey, Mahanoy City, Pa.
 120,930.—BOILER, ETC.—W. Baxter, Newark, N. J.
 120,931.—HUB.—W. G. Beach, New Haven, Conn.
 120,932.—GATE.—A. H. Betts, Cleveland, Ohio.
 120,933.—CROSSING.—G. W. Billings, Chicago, Ill.
 120,934.—REFRIGERATOR.—W. Bogk, Milwaukee, Wis.
 120,935.—CAR TRUCK.—G. E. Brown, South River, W. Va.
 120,936.—COFFEE POT.—R. Brown, E. A. Blaisdell, Goffstown, N. H.
 120,937.—STEAM GENERATOR.—W. Byers, Phila., Pa.
 120,938.—COFFEE POT.—S. L. S. Cawthon, A. F. Tatam, Troy, Ala.
 120,939.—WASHER.—J. R. Cazier, Hemlock, Mich.
 120,940.—PULLEY BLOCK.—H. Cherry, Birmingham, England.
 120,941.—BORING POST.—W. F. Cline, P. D. Weaver, Bendersville, Pa.
 120,942.—PRESS.—T. J. Corning, San Jose, Cal.
 120,943.—CORE.—J. C. Culver, Jersey City, N. J.
 120,944.—BEE HIVE.—S. Cuplin, Iowa Falls, Iowa.
 120,945.—STAND.—T. D. Carrier, Waldoborough, Me.
 120,946.—LIFTER.—J. Dingley, Gosport, Ind.
 120,947.—WRENCH.—A. B. Davis, Phila., Pa.
 120,948.—CUTTER.—T. J. Dickerson, O. B. Warren, Auburn, N. Y.
 120,949.—BAND SAW.—W. H. Doane, W. P. McKee, Cincinnati, O.
 120,950.—FIELD ROLLER.—G. J. Dow, Freeport, Ill.
 120,951.—HOIST.—G. Duerre, Williamsburgh, N. Y.
 120,952.—STILTS.—J. Emmert, Dunleith, Ill.
 120,953.—ANIMAL TRAP.—O. S. Ewing, Rome, Tenn.
 120,954.—CHUTE.—J. T. Fanning, Norwich, Conn.
 120,955.—MOVEMENT.—P. Ferguson, Newhaven, Conn., F. G. Bates, Springfield, Mass.
 120,956.—PAVEMENT.—L. S. Fibert, Phila., Pa.
 120,957.—FORGE.—L. R. Fitch, Chicago, Ill.
 120,958.—VALVE.—J. Garland, Providence, R. I.
 120,959.—HEATER.—B. Garvin, Oshkosh, Wis.
 120,960.—URINAL.—D. Gibbons, Rochester, N. Y.
 120,961.—BIDET.—D. Gibbons, Rochester, N. Y.
 120,962.—LAMP.—J. H. Gillis, Washington, D. C.
 120,963.—TORPEDO.—E. Gomez, New York city.
 120,964.—BRUSH.—J. A. Grant, Ottawa, Canada.
 120,965.—KILN.—W. P. Hall, Piqua, Ohio.
 120,966.—GUIDE.—W. H. Halladay, Chicago, Ill.
 120,967.—CORSET.—C. L. Hamlin, New York city.
 120,968.—WRINGER.—J. W. Hampton, Mt. Pleasant, Iowa.
 120,969.—SEWING MACHINE.—M. Harris, Jamestown, N. Y.
 120,970.—STAMP HOLDER.—G. C. Hatch, Calcutta, India.
 120,971.—FIXTURE.—L. C. Hoffmeister, Jr., Phila., Pa.
 120,972.—ORE CRUSHER.—S. Hughes, Charleston, S. C.
 120,973.—PUMP.—A. J. Hull, Sterling, Ill.
 120,974.—SEINE.—R. Jeffrey, Gloucester, Mass.
 120,975.—MOTOR.—J. H. Jennings, New Bedford, Mass.
 120,976.—CREST.—R. S. Jennings, Phila., Pa.
 120,977.—LIQUEFYING GAS.—W. F. W. A. Johnston, Brooklyn, N. Y.
 120,978.—LIQUEFYING GAS.—W. F. W. A. Johnston, Brooklyn, N. Y.
 120,979.—DEODORIZER.—A. Jordan, Washington, D. C.
 120,980.—VENTILATOR.—D. C. Justison, Wilmington, Del.
 120,981.—LADY'S DRESS.—A. Kelley, New York city.
 120,982.—GOVERNOR.—B. S. Lawson, Brooklyn, N. Y.
 120,983.—SEPARATOR.—S. Lessig, Sr., Reading, Pa.
 120,984.—ALLOY.—G. M. Levi, Brussels, C. M. Kunzel, Liege, Belgium.
 120,985.—WHEEL.—H. C. Lockwood, Baltimore, Md.
 120,986.—TOOL.—J. Maddy, Clearfield, Pa.
 120,987.—GRAIN CLEANER, ETC.—J. A. Maloney, Georgetown, D. C.
 120,988.—CHUCK.—J. Mansir, Richmond, Me.
 120,989.—FENCE.—B. F. Mears, Washington, Ind.
 120,990.—CARTRIDGE.—H. Metcalfe, New York city.
 120,991.—SOLDERING.—F. L. Miller, Brooklyn, N. Y.
 120,992.—STOVE GRATE.—R. Moss, Phila., Pa.
 120,993.—MORTISE.—E. Myers, S. R. Smith, Cincinnati, Ohio.

120,994.—MOWER.—J. S. Oakley, Passaic, N. J., O. D. Wood, Newburgh, N. Y.
 120,995.—COVER.—M. M. J. O'Sullivan, New Haven, Conn.
 120,996.—GLUE.—J. F. Peting, Rochester, Ind.
 120,997.—FIXTURE.—P. W. Phillips, Salem, Mass.
 120,998.—SHOE COUNTER.—S. C. Phinney, Stoughton, Mass.
 120,999.—DRAIN PIPE.—M. R. Pierce, New York city.
 121,000.—BUTTON.—C. M. Platt, Waterbury, Conn.
 121,001.—STOVE PIPE.—I. Racine, Hillsdale, Mich.
 121,002.—JACK.—W. L. Rayment, Union City, Mich.
 121,003.—HARROW.—W. Remyson, Norristown, Pa.
 121,004.—MAIN SPRING.—C. E. Rice, Jersey City, N. J.
 121,005.—HARVESTER.—E. B. Rice, Madison, Wis.
 121,006.—LINE HOLDER.—J. D. Sater, Greensburg, Ind.
 121,007.—SAW.—D. Sattler, Napoleon, Ohio.
 121,008.—LAMP.—W. Scarlett, Aurora, Ill.
 121,009.—WELDING.—C. L. Schurr, W. G. Rehbein, Balt., Md.
 121,010.—FEED.—H. Seyter, Valhingen, Wurtemberg.
 121,011.—ESCAPE.—W. A. Sharp, G. Hollenbeck, Tama City, Iowa.
 121,012.—PLANTER.—D. J. Sheers, Belmont, Wis.
 121,013.—BRAKE.—W. F. H. Smith, Milwaukee, Wis.
 121,014.—GUIDE.—W. T. Smith, West Zanesville, Ohio.
 121,015.—SNAP, ETC.—P. A. Snyder, Butlerville, Ohio.
 121,016.—PUMP.—G. Steck, F. Arnold, Hughesville, Pa.
 121,017.—THIMBLE.—A. Talbott, Richmond, Va.
 121,018.—VALVE.—J. F. Tallant, Burlington, Iowa.
 121,019.—STOVE LID.—W. Teemer, Evansville, Ind.
 121,020.—FISHING REEL.—S. B. Terry, Waterbury, Conn.
 121,021.—HARROW.—C. and G. P. Tharp, Bryan, Ohio.
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 121,023.—SPIKE.—T. R. Timby, Tarrytown, N. Y.
 121,024.—BASKET.—M. Tower, Boston, Mass.
 121,025.—HUB.—H. E. Vick, Alliance, Ohio.
 121,026.—WRITING APPARATUS.—A. Von Briesen, N. Y. city.
 121,027.—WRENCH.—N. Warren, J. C. Stock, Wilmington, Del.
 121,028.—PLANING MACHINE.—A. J. Watson, Lyons, Mich.
 121,029.—TILE.—D. H. Watts, Philadelphia, Pa.
 121,030.—JACK.—J. Weathers, Greensburg, Ind.
 121,031.—BANDING.—G. W. Weeks, Clinton, Mass.
 121,032.—CAR WHEEL.—J. M. Whiting, Providence, R. I.
 121,033.—HANK.—G. C. Williams, Boston, Mass.
 121,034.—CHAIR.—G. Wilson, Chicago, Ill.
 121,035.—RAKE.—J. E. Wisner, Friendship, N. Y.

REISSUES.

4,634.—LOZENGE MACHINE.—O. R. Chase, Boston, Mass.—Patent No. 39,395, dated July 7, 1853.
 4,635.—SEDIMENT COLLECTOR.—C. W. Deane, Philadelphia, Pa.—Patent No. 113,405, dated April 4, 1871.
 4,636.—SHEARING MACHINE.—T. E. Harris, Green Bay, Wis.—Patent No. 67,429, dated August 6, 1857.
 4,637.—VISE.—J. Simpson, Cleveland, Ohio.—Patent No. 119,638, dated October 3, 1871.

DESIGNS.

5,363.—BURIAL CASE.—S. Stein, Rochester, N. Y.
 5,364.—HAND STAMP.—W. N. Weedon, Boston, Mass.

TRADE-MARKS.

527.—TEAS.—Allen, Shapleigh & Co., Boston, Mass.
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 529.—CORSETS.—M. Cohn & Co., New York city.
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 543.—SKIRTS AND CORSETS.—Thomas, Langdon & Co., New York city.
 544.—GIN.—C. & W. A. Waters, Boston, Mass.

EXTENSIONS.

MOWING MACHINE.—J. P. Manny, of Rockland, Ill.—Letters Patent No. 18,310, dated October 27, 1857.
 GRINDING AND POLISHING MACHINE.—D. Lovejoy, of Lowell, Mass., and E. S. Butterfield, of Rockingham, Vt.—Letters Patent No. 18,520, dated October 27, 1857.
 HARVESTERS.—H. Willard and R. Ross, of Vergennes, Vt.—Letters Patent No. 18,562, dated November 3, 1857; reissue No. 1,775, dated September 27, 1864.
 HARVESTER.—H. Willard and R. Ross, of Vergennes, Vt.—Letters Patent No. 18,562, dated November 3, 1857; reissue No. 1,776, dated September 27, 1864.
 HARVESTER.—H. Willard and R. Ross, of Vergennes, Vt.—Letters Patent No. 18,562, dated November 3, 1857; reissue No. 1,781, dated September 27, 1864.
 SEWING MACHINE.—E. H. Smith, of Bergen Heights, N. J.—Letters Patent No. 18,605, dated November 10, 1857.

APPLICATIONS FOR EXTENSION OF PATENTS.

PLOWS.—George Watt, Richmond, Va., has petitioned for an extension of the above patent. Day of hearing, January 24, 1872.
 GRINDING ATTACHMENT PUG MILL.—David H. Gage, Dover, N. H., has petitioned for an extension of the above patent. Day of hearing, March 6, 1872.
 LAP JOINTS FOR BELTING.—Henry Underwood, Tolland, Conn., has petitioned for an extension of the above patent. Day of hearing, Jan. 24, 1872.
 BANK CHECK CANCELLERS.—William M. Simpson, Newark, N. J., has petitioned for an extension of the above patent. Day of hearing, Jan. 31, 1872.
 KNITTING MACHINE.—Joseph K. Kilbourn, New Britain, Conn., and Edward E. Kilbourn, New Brunswick, N. J., have petitioned for an extension of the above patent. Day of hearing, January 31, 1872.
 PROPELLING CANAL BOAT.—Herman Camp, Romeville, Pa., has petitioned for an extension of the above patent. Day of hearing, January 31, 1872.
 HARVESTER.—Frederick Nishwitz, Belvidere, N. J., has petitioned for an extension of the above patent. Day of hearing, January 31, 1872.
 SHINGLE MACHINE.—George Crane, Fairfield, Iowa, has petitioned for an extension of the above patent. Day of hearing, January 31, 1872.

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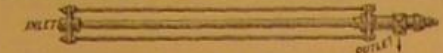
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(NEW SERIES.)

NEW YORK, DECEMBER 2, 1871.

\$3 per Annum.
(IN ADVANCE.)

CHURCH OF ST. PETER'S, BOURNEMOUTH, ENGLAND.

The general design of this church, as shown in our engraving, while it may compare favorably with church architecture generally, is remarkable for the fact that it was not designed at once, but at different periods, one part being, so to speak, patched on to another, until the building has attained its present proportions. The successful accomplishment of this difficult task furnishes a useful study for young architects.

First of all, a south aisle was added to a poor modern chapel of ease, then a north aisle, then a clerestory, so that the old chapel gradually disappeared. After this, in the year 1863, a very costly chancel with aisles was built. This is groined in stone, and has a sumptuous painted and sculptured reredos, the walls on each side of it being lined with charmingly designed groups of angels painted on tile. On each side of the eastern bay of the chancel are double screens of marble and alabaster, which form two ranges of sedilia. The two aisles on each side of the choir seats are occupied by lofty metal screens. In the wall on the north side of the chancel is a sculpture of the Crucifixion, while opposite to it is a sculpture of the Annunciation, and over the vestry door another, of the Charge to St. Peter. The vestry, on the east side of the north transept, is three stories in height, with a newel staircase. Below is the heating chamber, on the church level the clergy vestry, and above this the choir vestry. Almost all the windows throughout this part of the church are of stained glass.

Latterly it has been found that the church was not large enough, and an addition of a somewhat novel kind is now proposed by the architect; namely, a western transept, beyond which is a steeple. The steeple is already built up to the top of the tower, and the western transept will, it is expected, soon be built, so as to connect the steeple with the church. The tower is 25x25 feet, and 103 feet high to the top of the parapet. The height of tower and spire will be 188 feet. The lower stage is groined in stone, and the belfry is being provided with a heavy peal of bells.

A large churchyard cross, with sculptures on the base, and a lych gate, of stone and oak, are also being erected in the beautiful churchyard.

The extreme length of the church, when

completed, will be 180 feet. The whole of the work, with the exception of a portion of the south aisle wall, has been done from the designs of Mr. G. E. Street, A.R.A.

Steam Pressure Gages.

At the meeting of the Institution of Mechanical Engineers, held at Birmingham, on the 26th October, there was read a paper "On Steam Pressure Gages," by Mr. Ernest Spon, of London, communicated through Mr. Charles Cochrane. Of

this paper we subjoin an abstract:—The reliable construction of steam pressure gages is of much importance in connection with the safe working of steam boilers, a great number of the spring pressure gages in ordinary use having been found inaccurate, either from defects in original construction or in consequence of their becoming unreliable when in constant use. In the Bourdon gage, which is the spring pressure gage that has been the most extensively used for a great number of years, the indication of the pressure is obtained by the

employment of an elastic metallic tube, bent to a curved form, which, when subjected to internal pressure, becomes less curved; and the resulting movement of the free end of the tube communicates motion to an index upon a dial, through the intervention of a lever or a toothed sector and pinion. The elastic tube, however, is liable to become permanently strained by continued use, or by accidental exposure to an excess of pressure; and the indications of the gage are then no longer correct.

In the Schaeffer gage, the pressure is measured by the deflection of a circular corrugated steel plate, fixed round the circumference and bulged in the center by the pressure, the extent of the bulging being magnified upon a dial by means of a toothed sector and pinion. This gage, though it has been considered one of the best in use, has a disadvantage in the very small range of deflection of the plate under the pressure, requiring the motion to be very largely magnified upon the dial, whereby any errors are also proportionately magnified. The plate is also liable to be permanently strained by an excess of pressure, and is, moreover, liable to crack when continually worked. The metal of this plate being very thin, as is also the case with the elastic tube of the previous gage, its elasticity is liable to be diminished when any oxidation takes place, and error in the indications is then the consequence. The pressure is also measured by the bulging of a circular steel plate in Wallis' gage, but the deflection is increased by the plate being cut into five segments by radial slits; and a thin brass diaphragm, or a sheet of vulcanized india rubber, is used to cover the slits on the side exposed to the pressure. The brass diaphragm, however, is found too rigid to admit of the requisite sensitiveness in the gage; while the india rubber is liable to get forced into the slits by the pressure, thereby obstructing the action of the gage. A solid piston, working in a cylinder, is supported against the steam pressure by a steel



ST PETER'S CHURCH, BOURNEMOUTH, ENGLAND.

spring in Miller's gage, and is rendered steam tight in the cylinder by an india rubber diaphragm, which is fixed round the circumference between the flanges of the cylinder; the motion of the piston is communicated to the index by means of a short chain, coiled round the spindle of the index, and attached to the arms of a vibrating bow, which is actuated by the piston rod. The motion of the piston is limited to a very short range, owing to the risk of the india rubber diaphragm getting cut round the edge of the piston with a longer action; and the construction of the multiplying gear for the index involves objectionable complication. In Smith's gage, which has been extensively used, a steel volute spring is employed, and is acted upon direct by the steam on one side, being covered on that side by an india rubber diaphragm secured round the circumference to make a steam tight joint. This spring has a considerable range of action compared with the gages previously noticed, and being of considerable substance is not liable to be affected in strength by corrosion; the deflection of the spring moves the index by means of a rack and pinion. Three concentric spiral springs, placed one within another, with their ends covered by an india rubber diaphragm, are employed in Silvester's gage, which is similar in principle to the last one; and the motion is communicated to the index by a rack and pinion. There is, however, an objection to the employment of a rack and pinion, for actuating the index of a pressure gage, on account of the play occurring in toothed gearing; and in Foster's gage, in which the pressure is measured by the deflection of a volute spring covered by an india rubber diaphragm as before, the movement of the spring is transferred direct to the index, by means of a stud fixed to the center of the spring and working in a spiral groove in the spindle of the index. This pressure gage has been found by the writer to be superior to the other gages in use, in regard to durability, accuracy, and sensitiveness. The strength of spring employed is proportionate to the limit of pressure to be measured, the total range of deflection being the same in each case. Specimens were exhibited of the various gages described, and the action of some of them was shown by means of a force pump.

CORNELL UNIVERSITY.—A STUDENT'S LABOR FOR KNOWLEDGE.

A correspondent of the *New York Times*, recently visiting the Cornell University, describes, among other interesting particulars, a conversation held with one of the students. The interview gives a good indication of the qualities of the young man, who is a sample of a great many, in the Cornell and other institutions of learning, who are obtaining an education under what the world would call adverse circumstances. But although the labor is hard and the deprivations great, they form the furnace of trial, to refine the intellect, and produce a mental and moral state of sterling purity and value.

"I looked around for some student who could inform me as to the progress made in the specialty of Cornell—the self supporting part of the system. At last, by good chance, I came upon a room where a young fellow of twenty-three was studying Sanscrit. Having been in India for many years, I was interested in his studies, and we commenced an animated conversation upon philologic roots. We criticised Max Müller, commented on Bunsen's theory of the Pelasgic people, and heartily agreed upon the absurdity of studying Greek and Latin, which were dried sponges, out of which everything good had been taken by our ancestors. Incidentally I learned that this most accomplished gentleman was supporting himself by laboring on the farm. He generally worked three hours a day, and six hours on Saturdays, and had already got through his appointed labor for that Saturday. I asked him if the manual labor of plowing, etc., did not stupefy him, contract the brain cells, and make his apprehension duller. He replied that it did not, because he had been brought up as a farmer, and had nothing to learn when he came to the college. He was taking the agricultural course, but had become interested in philology, and one of the professors, who knew Sanscrit, had become interested in him, and had given him lessons in that perfect language, though Oriental studies are not in the curriculum.

I said: "I suppose yours is an individual case?"

STUDENT—Yes, as regards the philology, but not for the farm. There are twenty-five of us who work on it.

CORRESPONDENT—Does it pay your expenses?

STUDENT—It pays mine; but then I worked steadily during the long three months' vacation, which ended in September. I can go easy now if I feel inclined.

CORRESPONDENT—I suppose the hardest part of the work is done by laborers employed for that purpose?

STUDENT—Not at all. There are only two teamsters hired on the farm, and all the other work is done by us. At this moment we're laying down a series of drains, and this is very heavy work indeed.

CORRESPONDENT—Did you do that this morning?

STUDENT—Yes, for six hours.

CORRESPONDENT—And did you not feel stupefied or tired out?

STUDENT—Not at all. I dislike the work, and was very glad to get back to this, but I was not tired.

CORRESPONDENT—Are there any other methods of earning one's support here, besides the farm?

STUDENT—Oh yes. If you can print, you can earn more in the press room than on the farm, and soon there will be lots of work in the machine shop. The men are going to make copies of Ollivier's geometric models.

CORRESPONDENT—What's that?

STUDENT—Why, a Frenchman of the name of Ollivier made a set of models to illustrate all the problems of geometry. A

set was purchased by the State of New York, and is, I think, at Albany. They are going to make copies of these. Twenty thousand dollars were given, I believe, for the first set that he made, but our fellows here can make them for eight hundred.

CORRESPONDENT—I see. Well, but men who can't handle tools will not be able to do that sort of thing.

STUDENT—Certainly not. Skilled labor is at the same premium here that it is elsewhere.

CORRESPONDENT—What can the men do who have only their manual strength?

STUDENT—Well, they can work on the farm or they can grade the square.

CORRESPONDENT—They can do that, but then do they?

STUDENT—As a general thing they attempt it, and finding it rather rough, give it up in despair, and go home.

CORRESPONDENT—Well, but that was hardly what Mr. Cornell designed, was it?

STUDENT—No; he expected that the college would give work to every one, that cared to take it, of a kind that he could do. I suppose that this will be done in the future by outsiders, but it can never be accomplished by the college.

CORRESPONDENT—Something in the factory way, you mean. I suppose something that will utilize the grand water power that is running to waste so picturesquely in the gorges.

STUDENT—(laughing)—I guess so. I have heard that Mr. Cornell has some such scheme in his head.

CORRESPONDENT—But even then, perhaps, the men could not earn enough to keep them. Let us calculate a little. I have been through some factories in Auburn lately, and I learned the rate of wages current there. Such work as unskilled students could do would be paid at the rate of seven, say eight, dollars a week for a day of twelve hours. Now, how many hours can you average of work throughout the year?

STUDENT—About half a day if I work steadily through the vacations.

CORRESPONDENT—Very good; then that will only be four dollars a week throughout the year for everything.

STUDENT—That would be quite sufficient. My expenses are only three dollars a week, and I earn enough over to keep me in coarse clothes.

CORRESPONDENT—I beg your pardon for the seeming impertinence of the question I am about to ask, and I beg you to believe that the spirit that dictates it is not one of mere curiosity. Are you living in this fashion from necessity, or do you perhaps wish to show that it can be done by those who have no resources?

STUDENT—I do it from necessity; I am very poor.

CORRESPONDENT—Sir, from my heart I honor you, and if the sympathy of a stranger can lighten a road so stony, pray understand that you have it in the fullest sense of the word.

We shook hands heartily, and I left him to his Sanscrit, feeling as I walked away that Cornell meant something more than showed on the surface. We Americans have been rather apt to worship the dollar, but when poverty is so honorable and so honored as it is here, our golden idol is like to tumble a peg or so in the estimation of society."

The Unity of the Race—Waiting for Light—The World Older than Chronology—Science and Religion Reconciled.

From the *Brooklyn Daily Union*, we make the ensuing extracts of a sermon preached to his people, on Sunday, Nov. 18th, by Henry Ward Beecher, from the following text:

Acts xvii. 26, 27—"And hath made of one blood all nations of men to dwell on all the face of the earth, and hath determined the times before appointed and the bounds of their habitation; that they should seek the Lord, if haply they might feel after Him, and find Him, though He be not far from every one of us."

After showing that it was a great condescension for a Jew to say this thing, so opposite to both the Jewish and Grecian idea, he went on to speak of the light and darkness both thrown upon the relations of men by scientists. The speculation concerning the origin of the race is producing a two-fold mischievous effect. It unsettles the faith of some men, and others, seeing this, are driven away from all scientific reading. There is no doubt that the world is older, and that the race of man extends further back, than the six thousand years of chronology. But chronology is of purely human invention, and we touch no question of the Bible if we remove chronology thousands of years back. It is generally conceded by those who have the best opportunities of knowledge, that the present condition of things was developed from a lower condition. It is not a question of the Divine creative act (or need not be), but a question whether creation was unfolded by an instantaneous act or by slow evolutions. In regard to the creation of man we have

THREE THEORIES.

We have the theory of the creation of one pair, and all the rest descending from them. The second theory is that Adam and Eve were the ancestors of but one line, and that there were other lines. The third theory considers man as the natural outgrowth of the animal. This gives great offence to many on moral grounds, and to many on scientific grounds.

It is alleged that this theory cannot be sustained without leaving great gaps in the evidence. These speculations have had an effect on the public mind. Many inconsiderate and hasty persons have fallen from their faith and thrown away the Word of God. There are multitudes of men at the present time infected with the skepticism of science. These speculations lead the strong to domineer over the weak. It is said that the order of creation is that there are different planes, and the plane of one race is that of science to another. It is taught that rights belong to those who can defend them. Whatever theory may prevail of the origin of man will not

prevent the fact that man has come upon the earth by a divine method, and it concerns us more to know what man is than how he came here. There will not be ultimately any incongruity between true science and true religion. For one I am a patient waiter as to how man became what he is. I am bound to receive light, let it come from what quarter it may. Let men investigate, and let men not refuse the truth when it comes, for the truth is the best for us all. I am sure in the meantime, that the race is one in such a sense that they have the same rights and the same duties, and the same heritage. All spiritual elements fit all men alike, and the questions of the future are not disturbed by ethnological conclusions. I don't care if one man came from alligators, another

FROM MONKEYS,

another from lizards, if I find that they are all susceptible of reasoning and training. The important question is settled, if we find we can work men up in the same way, now that we have them here. How absurd it is to speak of the anatomical structure as proving divisions! The substantial plan is the same; all the great functions are the same. If it were true that the African had his heart in his liver, that would be a tough argument. A surgeon or a nurse would treat all races alike. In physiology and anatomy, it is assumed that men are are; and yet men read the skeptical books that have been written, and garrulous, know-nothing talk about the difference between the flat nose and the Grecian nose. Isn't smell the same in one as in another? In some families you will find the child radiant with imagination, and the next will be cold and practical; one will be full of song, and the next will be dumb. There are no greater differences in the families of races than we find here in the family on a small scale. You can educate animals to a small degree, but there is no development in generation; but the minute you strike the human race, you find that the reason is there, and you can enlarge it in every way. Educate a savage and his children will be better than he was, and so on till you have the high state of culture. This is a striking proof of the unity of the race and the sharp line that separates man from the animal. The love of the beautiful and the perception of wit and humor belong distinctively to man. All men laugh, and nothing below men. If sobriety is a great grace, then dogs beat the soberest man on the earth. According to any scheme of development, how could this humor be found? So the moral sense is common to all. The sentiment of conscience belongs to the whole human family, for conscience is a feeling that acts according to the understanding.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of September, 1871:

During the month 873 visits of inspection were made, and 1791 boilers were examined—1624 externally, and 491 internally—while 117 were tested by hydraulic pressure. Number of defects in all discovered, 886, of which 103 were regarded as dangerous. The defects in detail are as follows:

Furnaces out of shape, 32—5 dangerous; fractures, 56—11 dangerous; burned plates, 49—5 dangerous; blistered plates, 104—3 dangerous; sediment and deposit, 150—12 dangerous; incrustation and scale, 137—13 dangerous; external corrosion, 69—10 dangerous; internal corrosion, 46—3 dangerous; internal grooving, 13—2 dangerous; water gages defective, 71—2 dangerous; blow out apparatus defective, 18—2 dangerous; safety valves overloaded, 27—5 dangerous; pressure gages defective, 103—1 dangerous, varying from — 10 to + 7; boilers without gages, 3—3 dangerous; cases of deficiency of water, 3—1 dangerous; braces and stays broken and loose, 10—2 dangerous; dangerous caulking, 1; boilers condemned, 19. Attention is particularly called to the danger arising from careless caulking of boilers. A case was found where the skin of the plate had been cut so as to produce a crack some ten inches long, after only two weeks' use. The careless handling of the caulking tool may do serious injury. Boilers fed from water tanks situated overhead are very liable to be injured from the water leaking down, causing external corrosion. Such a case was met with the past month. The iron was so thin that a chisel could be easily driven through at several points, while the boiler in the main was sound. These "little matters," if neglected, soon become serious. An engineer's eye should detect all such defects, and have them remedied. Too small boiler capacity, requiring heavy firing, is a danger to which we have often called attention. We allude to it again. An upright tubular boiler was found with the fire box burned out. The iron was only $\frac{1}{8}$ of an inch in thickness in many places, and a slight blow of the hammer penetrated it. The day before 50 pounds pressure of steam was used. Here was culpable neglect on the part of the owner or user and an engineer, in no way fitted for his responsible duties. If steam users will persist in over working boilers, and in using them when not provided with proper fittings and attachments, explosions must be expected. There were six explosions during the month, by which 21 persons were killed and 6 wounded.

COATING COPPER AND BRASS WITH ZINC BY A WET PROCESS.—M. R. Böttger (*Polytech. Notizblatt*) gives the following formula: Cover, with a concentrated solution of sal ammoniac, zinc in grains or powder, placed in a non-metallic vessel; warm to ebullition and introduce into the mixture the objects of copper or of brass which it is desired to coat, after having properly cleansed them. After a few minutes, the objects will be covered with a brilliant, firmly adhering, deposit of zinc. The granulated zinc is obtained by pouring the molten metal into a warm mortar, and triturating vigorously, with an iron pestle, until it solidifies.

Water Supply and Farm Irrigation in Illinois--The Cost of Artesian Wells.

A correspondent of the Chicago *Tribune* gives an account of his visit to the agricultural portion of the State of Illinois, from which we extract as follows:

The question of water supply for farm stock is becoming one of no small importance in many parts of the State. Our prairie soils are capable of holding a large amount of water, but there are times, like the present, when a long continued drought exhausts this supply. It appears to me that one of the most important duties of the State Geologist is to give this department of practical geology his most earnest attention; for it is one that has much to do with agriculture.

A short time since, I spent a couple of days in the county of flowing wells, in order to learn something in regard to them. They vary in depth from 30 to 120 feet. The boring is through blue clay, such as is common to the northern part of the State, showing that the drift is of the same age as the country to the north and south of the location. Just before reaching the water, which appears to be infiltrated through a fine white sand, which, in places, is more or less mixed with gravel, there is a crust, or shell, of cemented sand and gravel, about two feet thick, and of great firmness, through which the auger is forced with difficulty. The well laborers know that, when they strike this band of hard pan, as it is called, they are near the coveted water. As soon as the "water sand" is penetrated, the real difficulty is met; for, if the sand is fine—that is, unmixed with gravel,—it is forced upward, and often fills the hole so firmly that it is difficult to clear it out. The value of the well depends upon the quantity of gravel present in the "water sand," as this allows the water a freer flow upwards, while the fine sand is liable to pack so closely that little or no water can find its way to the surface.

BORING AND PIPING.

A two inch auger is used in the boring. This is made for the purpose by a blacksmith, and is similar to a common auger, with a pad of some twenty inches. The boring is done by hand, and the auger is raised with a common hand windlass, with ropes and pulleys attached to a common three-legged derrick.

It often occurs that the auger meets a small granite boulder. Then the boring is abandoned and a new hole started, generally within a foot of the first. Sometimes three or four of these holes are made. It is difficult to drill through these isolated pebbles that are scattered through the clay drift, for they have been rounded by glacial action, and the blows of the drill make them change position in the bed of clay; hence it is found to be the most economical to start a new boring, and try the chances of passing down without meeting them. Formerly a four inch hole was bored, and this was tubed for some thirty feet, with wood tubing; but the two inch hole is now considered the better size, and this is tubed with one and a fourth inch galvanized gas pipe.

After the hole is bored, and the flow of water ascertained, the point of the gas pipe tube is prepared. If the flow is free, indicating a gravel stratum, large orifices are made in the point; but, if the flow is limited, indicating fine sand, the orifices are made of less size. This is attached to the pipe, and a careful measurement made, that passes the point into the "water sand," which is often quite shallow; for, if the point should go into the clay below this sand stratum, the water would be cut off. Sometimes the sand fills up the tube, and shuts off the flow of water. In this case a small pipe is inserted in the larger one, and water poured into the larger one; and by thus producing a hydrostatic pressure, the sand is forced up through the small pipe, mixed with the water, and the tube is thus cleared of the sand.

As the water is filled with sand, or, rather, as the water makes its way through this thin sheet of sand, it is evident that the force of the pressure is feeble, and that the flow must be not only moderate, but limited, at any particular point, and that an enlargement of the boring will have little corresponding effect on the flow of water, which will remain about the same, as more depends on the presence of gravel than the size of the boring.

THE COST OF A WELL.

At the time of my visit, Mr. W. H. Mann, of Gilman, had just completed his fourth well. It was 104 feet deep. The cost is as follows:

Man and apparatus, four days, at \$5 per day.....	\$20.00
Two men, four days, each \$1.50 per day.....	12.00
Hauling apparatus to and from well.....	3.00
104 feet pipe, at 27 cents per foot.....	28.00
One drive well point.....	3.00
Well trough.....	2.00

Total cost.....\$68.00

The usual price by the well jobbers is \$1 a foot for the well completed.

In the village of Gilman, a few rods west of the depot, is one of these flowing wells, that serves to supply the inhabitants with water. The water of all these wells is very clear, but slightly charged with iron, which, in time, coats the vessel with its oxide. The temperature is about 52 degrees. It is used for all domestic purposes, except washing, where rain water is preferred.

ITS VALUE FOR IRRIGATION.

Mr. Mann had given it a limited trial on some beds of forest evergreen seedlings and cuttings of the small fruits; but, not being familiar with the management of water in this manner, only made a partial success. From what I could see of this one experiment, I have little doubt of its final success.

In irrigating, the land must be made even, that is, the water must run in small drains flush with the surface, but, at the same time, must not be allowed to overflow, as the water is to simply soak into the soil, and to fill it with watery vapor.

In case it flows over the surface, it forms a crust that excludes the air, and is also liable to induce sun-scall of the plants, as we often see in the fields after a heavy rain, in places where the water stands on the surface for a longer or shorter period. That these flowing wells will materially add to the value of this part of the State, there can be no doubt. For the strawberry, nursery stock, garden vegetables, and grass, they must be invaluable.

The writer closes by recommending careful boring in all parts of the State to determine the water supply; and to this should be added a general topographical survey, connected with the Geological Department. Such a survey would no doubt show that the flowing wells of Iroquois county have their water supply from the east, near the Indiana State line; and it would also give us some idea of the bounds of this water district. Will some member of the Legislature look to these matters, and thus do something of practical value to the State?

NEW PUBLICATION--THE SCIENCE RECORD, FOR 1872.

We have in press, to be issued January 1st, a new book of 350 pages octavo, entitled as above, which, we think, will be read everywhere with interest. It will be a compendium of the scientific progress of the previous year, and is to be profusely illustrated with steel plate and wood engravings.

The following is a partial outline of the general contents of the *Science Record*:

Notices and descriptions of the leading discoveries and improvements invented or introduced during the past year, pertaining to Engineering, Mechanics, Chemistry, Philosophy, Natural History, Agriculture, Architecture, Domestic Economy, and the various Arts and Sciences, with many engravings.

Biographical notices of prominent men of science, with portraits.

Descriptions of the most important public works, begun or completed during the year, with illustrations.

Notes of the progress and extension of railways, telegraphs, and other means of communication.

Descriptions of the new applications of steam, electricity, and other motive powers, with engravings.

A complete almanac for the year, with the usual astronomical calculations, and a chronological table of notable scientific events and phenomena.

Reports of Patent Office proceedings. Classification of inventions at the Patent Office, with the names of all examiners, officials and employees.

Portrait and biographical sketch of the Hon. M. D. Leggett, Commissioner of Patents.

Full description of that great engineering work, the Mount Cenis Tunnel through the Alps, with engravings of the tunneling machinery, portraits of the chief engineers of the work, and other illustrations.

Description of the great Government works at Hell Gate, New York, with many illustrations, showing the wonderful galleries now being cut in the rocks under the bed of the East River, preparatory to removal of these obstructions by explosion, the drilling machinery, the electric apparatus, and other interesting objects.

Description of the great Suspension Bridge between New York and Brooklyn, now in process of erection, with interesting engravings.

Steel plate engravings of the celebrated Gatling Gun or Mitrailleur, showing its construction and use in various forms, upon wheels, horseback, camels, boats, etc.

Illustrations of recent improvements in cannon, fire arms, etc.

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Grinding Wheat without Millstones.

A very remarkable paper the contents of which are of especial interest to that large portion of our readers engaged in the manufacture of flour, was read at the late meeting in Edinburgh of the British Association by Mr. Thomas Carr. The document consisted of a description of a new mill for grinding wheat, called a disintegrating flour mill, and claimed to possess such extraordinary advantages as to entirely supersede the use of burrs. The wheat is reduced to flour by percussion instead of grinding, being projected through the air unsupported and with extreme velocity. In passing through the machine it is struck by a series of bars moving swiftly in opposite directions; and Mr. Carr asserts that by the action of these bars the wheat is so instantaneously reduced to a proper condition for bolting that no injurious heat is caused. One of these "disintegrating" mills is in use by an Edinburgh firm and has been some time in operation; and Mr. Carr describes in his paper the advantages it is claimed to possess over the millstones which it is expected to supersede. It is said to be much less frequently in need of repair than millstones, to require the labor of fewer men, occupy less space and call for less driving power. To the saving in wages and incidental expense is added by Mr. Carr the exemption from loss by scorching and consequent saving of fire insurance—the latter item being, we judge, of more theoretical than practical importance. The distinguishing feature, however, of the recommendation which is offered of this novel device, is that by the avoidance of injurious heat, claimed as a result of the peculiar method of reducing the wheat by percussion, a superior quality is produced. The theory is—unless, indeed, the practical experiment has been carried so far as to establish it as a fact—that the instantaneous nature of the process prevents the evolving of heat; an object which it is certainly very desirable to attain.

It is not easy to gainsay an ascertained and demonstrated fact; and if Mr. Carr's representation of the working of this remarkable machine is founded throughout on actual trial, we can only wait for an explanation of what now appears a very surprising statement. That no heat is produced in the reduction of the wheat to flour, simply because the process is swift and sudden, is a circumstance which certainly does not harmonize with other manifestations of the effect of the instantaneous force. A bullet fired from a musket strikes a wall with as sudden contact as can readily be imagined, but it does not follow that no heat is evolved in the concussion. The amount of the force applied in reducing, the wheat determines the amount of heat generated and it does not appear that, in the process described the force exerted is less than in the ordinary method. In point of fact, it might be reasonably expected that the more sudden and instantaneous the concussion, the higher will be the degree of temperature observed.

The real virtue of the new disintegrating process may after all consist, not in preventing the evolution of heat, but in speedily and completely remedying its effects. As the wheat is reduced while passing through the air, this rapid motion and exposure to the air may serve as an immediate antidote to the effect of the heat upon the flour, preventing, according to the claim of Mr. Carr, any injurious results to the product of the mill. As "the proof of the pudding is the eating," and a practical test the only conclusive argument—a fact which holds good in the manufacture of flour as strikingly as in any branch of industry with which we are acquainted—we shall wait with some eagerness for further reports of the working of the new process which is to revolutionize the flouring business and make the familiar mill burr an obsolete relic of the past.—*Leffel's Mechanical News.*

Lace Knitting Machine.

Mr. Henry Williamson, of Williamsburg, has invented a machine for knitting or crocheting lace, which consists in an arrangement of the hooks or needles so as to be capable of working independently of each other, and operated by Jacquard patterns, cards, or cylinders, with the thread guides all mounted on one bar. The object is to provide machines wherein the patterns can be varied to a great extent.

In this improvement, the arrangement and operation of the guides are the same as in other crocheting machines, except that, in this case the lateral movement of the guides is limited to crossing one or at most two needles, and all the guides used are mounted on one bar; while in the common arrangement the guides are divided among a number of bars, and the bars have a greater range of lateral movement, and are worked by a Jacquard mechanism to form the pattern.

Commonly, for making figured goods, there are from three to twelve of these bars, one above another, each having an equal number of guides arranged in the order of the said bars—that is, beginning at one end, one bar (say the top one) will have the first guide, the second bar from the top the second guide, and so on, repeating for every sixth or twelfth guide according to whether there be six or twelve of the bars; or they are sometimes arranged by twos or threes in each bar, but in the same order, and the said bars (as before stated) are worked laterally by a Jacquard to carry the thread across the hooks, according to the pattern to be made, one bar being moved laterally at each forward movement of the needle, while the others are allowed to rise and fall between the same needles, without supplying thread to them.

This arrangement is necessary to work out the patterns when the needles are all connected together, as in all the machines of this character heretofore made; and it has two important objections, which it is sought by the present improvement to avoid, namely: first, it necessitates the use of a large number of guide bars, and the supports and adjuncts thereof, which are objectionable and expensive; and second, with all the guide bars that can be used, practically, it is impossible to knit wide patterns; for there must necessarily be a repetition of the patterns as often as the order of the guides is repeated on the bars; with one bar only plain goods can be made. These objections are completely overcome by shifting the Jacquard to the needles arranged to work independently of each other, in connection with only one guide bar operating as described, and carrying all the guides, by which the single pattern may be as wide as the fabric knitted, with no repetition, as will be clearly understood; for the number of needles receiving the yarn at each movement, and the order of their receiving it, will be governed entirely by the pattern cards or cylinders.

At the last meeting of the Council of Directors of the Iron and Steel Institute of Great Britain, it was decided that the next general meeting shall be held in London, on March 19, 20, and 21, 1872; and that special invitations be addressed to foreign metallurgists, soliciting the honor of their presence at the meeting.

When a storm commences in the United States, the line of minimum pressure does not come from the "far west," but commences with the storm, and travels with it towards the eastward.

Improved Torpedo Boat.

We illustrate, in the accompanying engraving, a torpedo boat, which was made the subject of a paper, read at the last meeting of the British Association, by Mr. Philip Braham. The torpedo, A, consists of a chamber filled with dynamite at the pointed end—a shaft of wood of any convenient length, and a corrugated iron cap, of sufficient weight to make the torpedo or submarine rocket float nearly horizontally.

The torpedo is propelled through a bored cast iron tube, B, from the boat, below its water line, by the expansion of compressed air.

The compression chamber, C, is a strong double riveted boiler, into which air can be compressed to 500 lbs. to the square inch, by machinery driven from the boat engines. The boat is plated to render it practically invulnerable; the boilers are high pressure; the twin screws, driven by a differential motion of novel construction, are below the bottom.

When the boat arrives within striking distance of the ship attacked, the officer in charge, who views the enemy by a mirror to prevent his personal exposure, turns the handle of a four-way cock, D, which admits air from the compression chamber under the piston in the cylinder, E, and opens the valve leading from the compression chamber to the tube, arranged so as to give a powerful, elastic, and prolonged impetus to the submarine rocket, which, strikes the enemy below the water line, exploding the percussion fuze, and smashing in square yards of the side.

By the reaction of the force driving the rocket forward, which would average upwards of 80 tons on 1 foot 9 inches, shown, the boat would have its speed considerably diminished, if not entirely neutralized. There is also a sluice valve and breech, whereby a fresh rocket can be introduced when the first has exploded.—*Engineer.*

Adjustable Elastic Measuring Scale.

Baptist Edme Chassaing, of Buenos Ayres, Argentine Republic, has invented a new adjustable scale and equi-divider, the object of which is to provide an improved instrument for quickly and accurately constructing a drafting scale, and for dividing lines within certain limits of length into equal parts, it being designed and adapted chiefly for use by the draftsman, civil engineer, and architect. A round rod of brass or other suitable metal, has a fixed head or radiating arm at one extremity, and a similar arm movable throughout its length, provided with a set screw. Throughout the length of the rod there is a small groove, into which pins upon the heads fit, preventing them from turning. Between the two arms is stretched an elastic rubber band, fastened to the arms. This rubber band is divided upon its four face edges into a certain number of equal parts, which are subdivided into equal minor parts, and is the scale proper. The band is a tube of soft rubber, about two and three fourth inches external diameter, one fourth inch wide, and about one twenty-fourth inch thick, being perfectly accurate in its dimensions and homogeneous throughout. A small pin, having a T shaped head and perforated with a small hole, works loose in the fixed head and is held in place by a washer and rivet or nut. The object of the circular form of band is two fold: First, to compensate for any tendency to unequal stretching. Second, to provide a means of attachment, without forcibly confining any portion of its surface between fixed jaws, or in any way reducing the strength of the band at the points of attachment by piercing or otherwise.

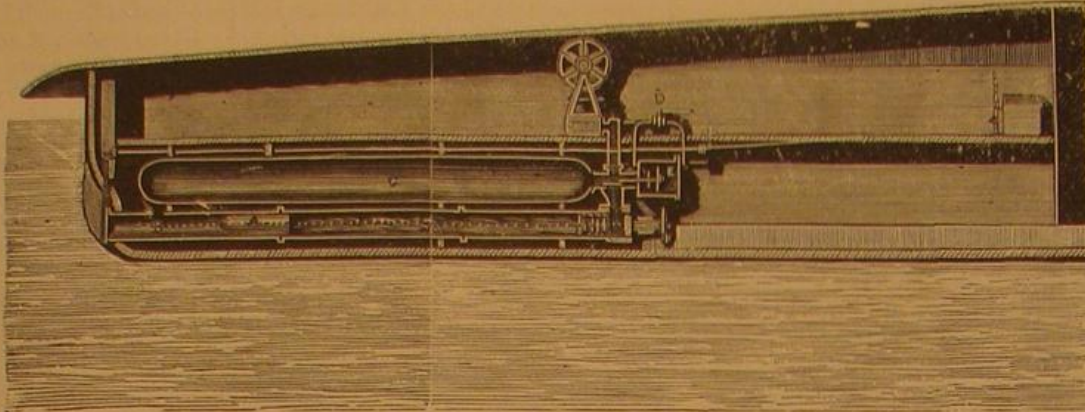
To use the instrument, let it be desired to provide a scale of one eighth, one fourth, one half, five eighths, three fourths, one, one and one fourth, one and one half, two inches, etc. Then imagine that one side of the adjustable band is divided into one hundred equal parts, and that its capacity is twelve inches. The ten inches equals eighty eighths; hence, if we apply the scale to a standard rule, making eighty divisions, equal to ten inches, upon the rule, we have at once an eighth scale. Secondly, ten inches equal forty fourths; hence, if we apply the scale to a rule making forty divisions, equal to ten inches, we have at once a one fourth scale, and so on for the remaining scales enumerated; but no one side of the scale will admit of all of these adjustments; hence the four edges are differently divided, to suit all requirements. Suppose it be required to measure a plan or map having a drawn scale depicted. It is only necessary to adjust the scale to the scale of plan or map, and use it accordingly. If it be desired to divide a line of length not greater than twelve inches—though lines of greater length, when required to be divided into equal parts not prime, may be also divided by previous subdivision—it is only necessary to extend or contract the band, using the edge giving the required number of divisions within the scope of the instrument, so that the required number of equal parts will correspond with the length of line to be divided; then point off with pen or pencil the divisions so indicated. This last feature of the instrument renders it essentially useful to the draftsman, as it avoids the old long and tedious way of stepping off with dividers, which often requires that a line should be frequently gone over, and, unless great care is taken, it is seriously marred. The band is made of white rubber, as soft and pliable as possible. It will, of course, be required to be made for this special purpose, and must be made with perfect accuracy of dimensions throughout. The divisions will of course be made by machinery, and all sides of the scale will be graduated when

stretched to its utmost capacity. The figures will, however, be stamped upon the band when it is extended to half its scope, as they will then be most legible at all points of the extension.

The scale will be divided as follows, though other divisions may be found more suitable than those enumerated: First side, one hundred equal parts, subdivided into halves and fourths. Second side, fifty equal parts, subdivided into sixths. Third side, eighteen equal parts, subdivided into twelfths. Fourth side, eleven equal parts, subdivided into twenty fourths.

Fire Safes—Test of Material.

We have received, from an eminent chemist, the following suggestion:—"Can you induce some of the rich fire safe

**BRAHAM'S TORPEDO BOAT.**

manufacturers to have an investigation made into the heat conducting and other powers of various substances, with a view to their use as an exterior covering of safes?"

No doubt many of our readers are interested in this question as safe makers and sellers, and many many more as safe buyers and users. Will any practical man let us know the result of a few experiments on this subject, which is now engrossing the attention of the public?

BRIESEN'S WRITING APPARATUS FOR THE BLIND, ETC.

The subject of the accompanying engraving differs materially from the general run of modern improvements, as it is not intended to perfect anything already in use, nor to subvert the comfort of the general public. The object is primarily to relieve that most unfortunate class of our fellow beings, the blind, from their chief enemy, inactivity; and also to prevent injury to or loss of the eyesight, in persons who find their sight failing by too close and constant attention to literary pursuits. In fact, this little machine is no more nor less than an apparatus by the aid of which one can write without using the eyes.



It is composed of a tablet on which the paper to be written upon is placed, of a spring clamp on the left side, whereby the paper is held firmly on the tablet, and of an adjustable hand guide which can slide up and down on a rod that is connected with the clamp. The hand guide is similar in form to an ordinary wooden ruler, and extends transversely across the paper.

The writer guides the little finger of his right hand along the top edge of the ruler, and is thereby enabled to carry the pen or pencil in a straight line. When a line has been written, a small knob at the left end of the hand guide is touched, and raised out of a notch in the rod *a*, which causes the hand guide to slide on the rod, until the knob springs into another notch and locks the hand guide in position for another line. The rod is notched at proper intervals from one end to the other, so that the hand guide will be arrested at each adjustment, to properly space the lines written.

The inventor considers the machine to be valuable for persons who have lost their eyesight after having previously learnt to write. For these it will be, as it has already been proved, a perfect boon, enabling them to occupy themselves, and giving them a degree of independence never before enjoyed by persons similarly afflicted. But also, literary men, clerks, copyists, and all writers whose eyes are materially strained by constant writing, are expected to profit by the use of this machine, as they may, by its aid, write with-

out continuously looking at their work. The apparatus was patented through the Scientific American Patent Agency November 14, 1871. Those desirous of availing themselves of its benefits may address the manufacturer, V. E. Mauger, at 110 Reade street, New York city.

The Royal Condor.

The condor has been singularly unfortunate in the hands of the curious and scientific. Fifty years have elapsed since the first specimen reached Europe; yet to-day the exaggerated stories of its size and strength are repeated in many of our text books, and the very latest ornithological work leaves us in doubt as to its relation to the other vultures. No one credits the assertion of the old geographer, Marco Paulo, that the condor can lift an elephant from the ground high enough to kill it by the fall; nor the story of a traveler, so late as 1830, who declared that a condor of moderate size, just killed, was lying before him, a single quill feather of which was twenty good paces long! Yet the statement continues to be published, that the ordinary expanse of a full-grown specimen is from twelve to twenty feet; whereas it is very doubtful if it ever exceeds, or even equals, twelve feet. A full grown male from the most celebrated locality on the Andes, now in Vassar College, has a stretch of nine feet. Humboldt never found one to measure over nine feet; and the largest specimen seen by Darwin was eight and a half feet from tip to tip. An old male in the Zoological Gardens of London measures eleven feet.

The ordinary *habitat* of the Royal Condor is between the altitudes of 10,000 and 16,000 feet. The largest seem to make their home around the volcano of Cayambi, which stands exactly on the equator. In the rainy season they frequently descend to the coast, where they may be seen roosting on trees; on the mountains they very rarely perch (for which their feet are poorly fitted), but stand on rocks. They are most commonly seen around vertical cliffs, where their nests are, and where cattle are most likely to fall. Great numbers frequent Antisana, where there is a great cattle estate. Flocks are never seen except around a large carcass.

It is often seen singly, soaring at a great height in vast circles. Its flight is slow and majestic. Its head is constantly in motion as if in search of food below; its mouth is kept open and its tail spread.

To rise from the ground, it must needs run for some distance, then it flaps its wings three or four times and ascends at a low angle till it reaches a considerable elevation, when it seems to make a few leisurely strokes, as if to ease its wings, after which it literally sails upon the air. In walking, the wings trail on the ground, and the head takes a crouching position. It has a very awkward, almost painful gait. From its inability to rise without running, a narrow pen is sufficient to imprison it. Though a carrion bird, it breathes the purest air, spending much of its time soaring three miles above the sea. Humboldt saw one fly over Chimborazo. We have seen them sailing at least a thousand feet above the crater of Pichincha.

Its gormandizing power has hardly been overstated. We have known a single condor, not of the largest size, to make way in one week with a calf, a sheep and a dog. It prefers carrion, but will sometimes attack live sheep, deer, dogs, etc. The eye and the tongue are favorite parts, and first devoured; next the intestines. We never heard of one attacking adults except in defence of its eggs. Von Tschudi says it cannot carry, when flying, a weight of over ten pounds. In captivity it will eat everything except pork and cooked meat. When full fed, it is exceedingly stupid, and may be caught by the hand; but at other times it is a match for the stoutest man. It passes the greater part of the day sleeping, more often searching for prey at morning and evening than at noon—very likely because objects are then more distinctly seen.—*Professor James Orton.*

CLAY AND SANDY SOILS.—If you have a light sandy field and wish to fertilize it cheaply, perhaps you cannot do better than to gather, say ten loads of clay, and mix it with ten loads of barn yard manure or compost; this will be found as effective, perhaps more so, than twenty bushels of manure without the clay. And the reverse we believe, will also hold good; that is, to a stiff clay soil, add the same quantity of sand and manure; the texture of the surface soil is changed thereby.—*Virginia Real Estate Journal.*

A PIECE of building land, at the corner of the new Queen Victoria street, in London, has just been let at a rental of £5,500 per annum, being at the rate of about five dollars per square foot. Business must be better in London than in New York, at the present time, to enable the tenant to afford payment of such rental.

PROFESSOR GEIKIE, an eminent geologist and writer, is Sir Roderick I. Murchison's literary executor. Sir Roderick has left behind him voluminous papers and documents, and from these and from personal knowledge, Professor Geikie will write and publish a life of the renowned President of the Geological and Geographical Societies.

TRUST him little who praises all; him less who censures all; and him least who is indifferent about all.

Saw Manufacture at Sheffield.

First, the saw is cut out of the sheet. If a heavy or large saw, it is never toothed while soft. The third stage is that of hardening. Placed in a structure like a baker's oven, and floored like a baker's oven with brick, the saws are left there to harden, and when they come out they are, when cool, brittle as glass. To abate this brittleness, they are put into a composition, where they lie, for a time, in a sort of oily bath. This makes the fourth stage. After this they are tempered over a coke fire, watched by men who, guided by their experience of color, take them out when they have acquired the tint which will leave them with a blueish hue, that indicates, to the practised eye, the amount of elasticity in them. At this point you may bend them like whalebone from heel to point, so elastic have they become. This makes the fifth stage. The tempering warps them, and they now require to be flattened. The flattening is the work of the "smiths," who hammer and beat them into an attitude of precision. This makes the sixth stage. Now the blades have to be ground and glazed. This makes the seventh stage. The saws, being now flat and bright, have their teeth "set," by the laying over the edge alternately, and with the setting the sharpening is associated. This makes the eighth stage. At this point it is necessary to restore to the saw blade the measure of elasticity which has been taken from it by the processes of rubbing and glazing, so it is put into the oven; for the mere rubbing or glazing of the saws does, somehow or other, extract from them a large amount of the elasticity imparted to them by the tempering process, and for this reason they are heated to restore to them their lost suppleness. This makes the ninth stage. When they come out of the oven, they have on them a sort of straw tinted bronzing, which has to be removed. To remove it, they are placed in a bath, which immediately takes it off. This makes the tenth stage. The saw has now to be etched. This is the eleventh process. If a hand saw, it needs the hold for the hand or handle to be put on, and this is done with remarkable dexterity and when done the twelfth stage is completed. Nothing remains now but to have the saws examined. Messrs. Spears and Jackson, of Sheffield, make circular saws of from one inch to ten inches in diameter. These miniature circulars are exquisite specimens of the sawmaker's art, are chiefly destined for Paris, there to be employed by silversmiths and others in the production of those beautiful and ornamental articles for which Paris stands unrivalled. They also make saws on models which it is proved are from two to three thousand years old. These are for the Hindoos, and have the teeth set towards the handle, so as to cut by the up stroke instead of the down. Saws are of an almost infinite variety—some narrow as lengths of steel tape, some round and broad as a cart wheel or the top of a large loo table. Some have beautifully small teeth, others have teeth larger than a horse's. Some are destined for the most delicate operations of fancy cabinet work, and some are to be employed in sawing Bessemer steel rails by steam, at the rate of 800 revolutions per minute, while others are framed to spin along with a rasping sound all day long, cutting their way through the largest logs of timber in the naval dockyards.

The saw trade is a very ancient one, for the saw itself is figured on the ancient monuments of Egypt and Babylon. The cutting out of the edge in the form of teeth is done by machines, and where the teeth are small it is done at the rate of 400 per minute. The usual way to set the teeth is alternately to the right and to the left, before completing the saw; but in the East, where ancient usages are preserved, the teeth of the large saws are bent aside in groups of perhaps a dozen each. The sharpening and setting of a saw requires considerable skill of hand and accuracy of eye; for if any one of the teeth projects either edgewise or sidewise beyond the true line, it renders the sawing harsh and difficult. When the teeth of a hand saw become blunted by use, they are sharpened again by means of a three-square file; but previously to this, comes a necessity for turning the saw to the fire where it is heated.—*Ironmonger.*

Metropolitan Railway of Paris.

We translate the following from *Le Moniteur des Intérêts Matériels*:

An important project was submitted to the Municipal Council in Paris during its last session. Its object was an underground railway to be completed by private enterprise, without subsidy, either from the State or the city. The scheme is not a new one, complete plans and designs of such a system having been presented to the Government in 1864, by M. Mouton. It is this project which has recently been again put into shape.

According to these plans, the railway will commence at Longchamps, will follow the course of the Avenue de la Grande Armée and the Champs Elysées as far as the Place de la Concorde, and, going along the Rue de Rivoli (the railway being the axis of the section of the main subways), will reach the chief market (Halles Centrales), and subsequently the depots of the railways of Vincennes and Lyons, and that of Orleans by passing over the Seine on a viaduct.

A branch will leave the main line at the Halles Centrales, going towards the depots of the Northern and the Eastern Railways, and rejoining the Belt Railway (Chemin de Fer de Ceinture).

Two other branches, leaving the Palais Royal station, will extend, one towards the depot at Saint Lazare (west, right bank of the Seine) and the other towards the depots at Mont Parnasse (west, left bank) and d'Orsay, by crossing the Seine in a tunnel and following the line of the Rue de Rennes.

All the depots will thus be united to the Halles Centrales. The greatest depth under ground in this railway will be

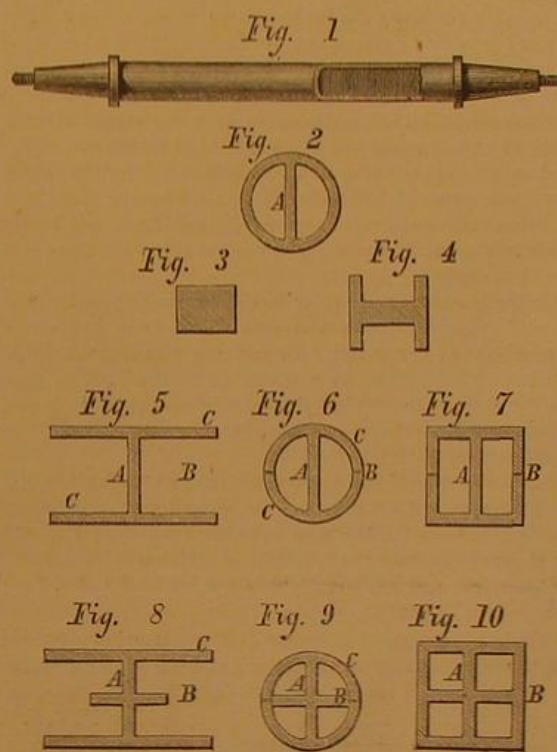
13.5 meters, while the Metropolitan Railway of London in many places descends to a depth of 17 meters.

The tunnel will have a width of section of 60 meters; the surveys will be made similarly to those for the underground railways of London, which have been operated for many years past with complete success. When, seven years ago, this project was submitted for the first time to the Prefect of the Seine, it was returned for examination by the two engineers-in-chief of the city. M. Belgrand reported that the scheme gave every satisfaction to the needs of his important branch of the service, that of the subways. M. Alphand made the same declaration, subject to his examination of the design for the station to be established at Longchamps.

This great work deserves the attention of the Municipal Council. There are no technical difficulties to hinder the construction of a network of subterranean ways in Paris; and we believe that statistics of the probable traffic will convince the public that the capital employed will obtain a large profit.

IMPROVED AXLE FOR RAILWAY CARS AND LOCOMOTIVES.

What proportion of all the destructive accidents on railways originate in the breaking of axles, we have not statistics at hand to determine. It is certain, however, that much destruction of life and property has arisen from this cause. On the 6th of February, of the present year, the public was horrified by the account of such an accident, at New Ham-burgh on the Hudson River Railway, the terrible details of which are still fresh in the minds of all our readers.



This instance alone, of the many similar ones that might be recorded, is enough to illustrate the importance of any invention giving greater strength and security to axles. Such an invention will be appreciated, not only by those who incur the personal risks of railway travel, but especially by railway companies, whose interest it is to avoid all such disasters and the pecuniary loss and reputation for insecurity resulting therefrom.

Such an invention we herewith present to our readers. It furnishes, without doubt, a much stronger axle in proportion to its weight than are the axles at present in use; and experts who have examined it assert that it can be made as cheap, or nearly so, as the ones now employed.

The strength of a given weight of metal, when formed into a hollow cylinder, has long been known to be much greater than when wrought into a solid cylinder. Galileo was the first to demonstrate mathematically the proportionate strength of hollow and solid cylinders. He showed that the resistance of a hollow cylinder is to that of a solid one, of the same length and weight, as the radius of the hollow cylinder is to that of the solid one. According to this formula, the strength of a hollow cylinder, the metal of which would make a solid one of the same length and one twentieth the diameter, would be 4.47 times stronger than it would be were it wrought solid. The theories of Galileo relative to the strength of materials were based upon the assumption that the fibers of beams are neither elongated or compressed by the strains to which they are subjected, each acting with equal energy throughout their cross sections. Robert Hooke, in 1678, announced the fact that fibers are compressed on the lower side and extended on the upper side of beams subjected to downward transverse strains. Mariotte, in 1686, investigated the position of the neutral axis, or the points in the sections of beams, subjected to neither extension nor compression; and the results of his researches were confirmed by Leibnitz in 1684. Parent, in 1713, published the following principle, namely, that "the total resistance of the compressed fibers equals the total resistance of the extended fibers." Coulomb, in 1773, generalized this principle to make it applicable to beams upon which forces are applied in an oblique direction. In 1807, Young investigated the modulus of elasticity. Other investigators followed these researches, adopting some false principles, but all struggling to arrive at truth on a difficult subject, some points in which are still matters of debate. The reader will find much interesting historical matter in connection with the subject, in Wood's "Treatise on the Re-

sistance of Materials," published during the present year by John Wiley & Son, New York, and from which the above synopsis is compiled.

The result of all these labors has led to the construction of formulae different from that of Galileo, based upon the results of extended experiments with various kinds of materials. The relative strength of solid, as compared with hollow, beams, has not received the share of attention that, in our opinion, its importance demands. And although it has been shown that a tube of rectangular section, whose height is considerably greater than its thickness, will sustain a greater amount of lateral pressure than a hollow cylinder of the same thickness, it is obvious that this can only be the case when the strain is applied in one direction.

The results of actual experiments are better guides for the estimate of relative strength of hollow and solid cylinders than any formulae that can be adduced.

A round tube, whose external diameter is to its internal diameter as 10 is to 7, has, according to Tredgold, twice the strength of a solid cylinder of the same length, material, and weight.

Experiments conducted in England, in 1842, an account of which is given in the *Mechanics' Magazine* (Vol. XXXVIII., page 254), gave the following results: "A weight of six hundred pounds was allowed to fall from a height of nine feet upon solid railway axles, and with that force they were frequently broken at the second blow, and sometimes at the first; while, by letting ten hundred pounds fall on hollow axles from a height of fifteen feet, not one of them was broken."

The invention under consideration consists in the construction of tubular axles, round, oval, or square, with one or more interior longitudinal strengthening webs or supports. The object of the invention is to manufacture all sorts of axles, which will be much stronger, lighter, cheaper, and better lubricated than any axles now in use.

Fig. 1 is partly a side view and partly a longitudinal section of a cylindrical axle so constructed. Fig. 2 is a transverse section of the same. Fig. 3 is an end section of a bar of which the axle is made. Fig. 4 is an end section of the same, after once passing through the rolls, and indicates the manner in which the completed blanks, Figs. 5 and 8, are produced. Figs. 6 and 7 are forms produced from the form shown in Fig. 5, and Figs. 9 and 10 are made from the form shown in Fig. 8, by uniting the edges of the parts, C, at B, and properly welding them there. Fig. 6 is an end section of a vehicle axle, with one internal longitudinal web, to strengthen it and prevent it from collapsing. Fig. 9 is an end section of a railroad axle, with a perpendicular web, crossing a horizontal one at right angles.

The hollow chambers in the axle have been found to afford great facilities for lubricating, and it is quite evident that the addition of the web to the hollow cylinder forms the lightest and strongest axle that can be made on any principle yet discovered; and, from the amount of metal saved, we should judge that it is also the cheapest. Such axles may be rolled or cast, and, by recesses of suitable shape in the rolls or molds, they can be made square for about ten inches inside the collar washer, to receive the clips which hold vehicle axles from rotating.

The internal webs prevent the buckling of the external tube without great increase of weight, and the strength thus gained is self evident. We see no practical reason why such axles as these should not be generally adopted, and if this be the case, the invention will give rise to an extensive and important branch of industry.

It was patented, Oct. 31, 1871, through the Scientific American Patent Agency, by Joseph W. Crenin, 213 East Fifty-first street, New York, who may be addressed for further information.

Leland's Galvanic Battery.

This invention has for its object to produce an electric battery which will operate continuously without requiring attention, as long as it remains provided with the requisite exciting substances. The invention consists in placing within the porous cup, containing the platinum element, sulphate of mercury alone or mixed with black oxide of manganese, and in surrounding the cup with water, which is in contact with the zinc. This combination, it is claimed, produces reliable action, and is very economical, as the spent sulphate of mercury falls to the bottom of the cup in a shape to be readily reconverted.

The inventor states that, by connecting the poles of the platinum and zinc plates, a steady action is maintained until the sulphate of mercury is entirely decomposed and falls to the bottom of the cup as metallic mercury, ready to be reconverted into sulphate of mercury. This insures great economy.

This battery will, it is claimed, work weeks or months without attention, except perhaps the filling up of evaporated water, and the supply of sulphate of mercury. No acid being required, offensive fumes are avoided, and much steadier action is insured.

The improvement is the invention of Mr. Edwin J. Leland, of Worcester, Mass.

AN English author, Miss Meteyard, remarks in her life of Wedgwood, that the earliest mention of the photographic art is a discovery by Thomas Wedgwood in 1791. She gives a *fac simile* of the earliest sun picture on record, and states that she has traced the connection between the Wedgwood family and the Frenchman Dominique Daguerre. This version of the origin of the universal and beautiful art of photography shows it to be much older than people generally suppose, and adds an additional lustre to the name of Wedgwood.

Correspondence.

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

Street Cars.—Atmospheric Engines.—Economy in their Use.

To the Editor of the Scientific American:

Your article last week in regard to the propulsion of street cars by steam, and your expressions contained therein, in regard to the want of street car companies of a reliable and cheap means to take the place of animal power, have brought to my mind some reflections which, I think, may be of service and interest to your readers. It is a fact, long since patent to every thinker, that the humane spirit of the age is much averse to the killing of horses by their use in street car propulsion, and loudly calls for some radical improvement in that direction. It is further true that street car companies are ready, willing, and waiting to "look at" something that will meet the want, if it will diminish the cost of running cars.

For two years past I have given much thought upon this matter, have visited numerous street car companies' offices and stables, and have learned the want; and I will, if agreeable to you, give some facts, as I have gleaned them, as I often see that you urge upon your readers that "one fact is worth a thousand theories."

I find that there is a prejudice against any vehicles, in a street, not drawn by a horse. This, however, is only a matter of education, and will vanish as soon as the coming man will bring forward a machine which will move street cars back and fro, with the conditions substantially as set forth below. These are things which must be attained, and which education cannot overcome.

One important feature is simplicity. It must be of such ease of manipulation that any common laborer of ordinary sense can be "picked up" and in a few hours made master of the situation, in starting, running, and stopping a car. This makes it practicable for companies to run their cars without hindrance and with economy.

It is necessary that the machinery to run each car should be under it, or in such manner concealed as to hide such deformities as are repulsive to the presence of human beings and the eye of brutes.

The absence of fire, smell, smoke, and the accompanying sense of danger, and the use of all the space above the wheels for carrying capacity, are required.

It imperatively demands that no extra car or dummy should be used. It is a very great matter to get rid of the extra weight and wear and tear of machinery incident to carrying the motive power on extra wheels. The percentage of repair and necessary help to run the same operates fatally. In other words, when the coming man shall discover the means of running street cars without carrying the motive generator or power with the car in such weight and bulk as is required in the use of steam, hot air, furnace, etc., there will be a revolution in running street cars. If the coming man can place, say a 100 horse power engine in some by-alley or to one side, and with one engineer and fireman propel successfully thirty to fifty cars, then it will begin to look as if things were assuming shape.

Great exertions have been made to accomplish this desired end in the transmission of air. To this end I have made various experiments, and for the benefit of those whose minds are running in this direction, I will give some of the results. I find it expensive to condense air at high pressure. It must be worked, say at forty pounds to the inch, and better at thirty. It is so very subtle that, in order to condense it without too great a loss from leakage, it is necessary to have machinery in the very finest condition, and it must be kept so. It requires a large tank to draw from. It is only successful to use a large reservoir, with which the engine can be in constant connection. This gives regularity in the motion of the engine.

The engine for using compressed air is substantially the same as for steam, with the exception that it should be somewhat freer in the exhaust. It is impracticable to carry a tank or tanks on the cars filled with air. It is nicer and cheaper to place springs on the axles, and wind them up by steam or horse power. But this plan is not practicable. Such power is not reliable, and cannot be depended on under the various circumstances in which a street car is found. For instance, the wheels slip, as in sleet and wet; the power calculated to take the car to the next railway station is not enough; it is wasted in the slipping. Besides, it becomes clumsy, and lacks the essential simplicity spoken of above.

The cost of compressed air, forced into a large tank by engines and windmills, is trifling compared with horse power. For instance: It costs, say, in Chicago on the south side, at least fifty cents per day for feed and grooming a horse. They run eighty cars and use 500 horses. This foots up to the snug little sum of \$250 per day for motive power alone. Two men can run a 125 horse power engine with three tons of coal, at a cost of \$20 to \$25 per day for motive power. Now you have the wear of horses, harnesses, and shoeing, with the interest on capital in stable and fixtures to offset the repair of engine in compressing air.

You see the snug little difference that will appear to the capitalist's eye of at least \$225 per day, or \$82,125 per year, counting Sundays, one of the best days for street car travel. This is no idle chimera; it only wants the coming man to apply this force in the manner above mentioned. By the use of air from large reservoirs, much longer street cars can be used for early and late travel in large cities, to take operatives to their work and home at night. This is a want in cities. In fact, some strong, reliable power must be devised to bring the suburbs of cities into close proximity, as it were,

to the center. It will greatly enhance the value of suburban property, as well as properly down town.

Inventors will bear in mind that the first cost of putting down apparatus, pipes, machinery, etc., to run street cars, does not cut such a figure as might first appear. The only questions are its permanence and cheapness of operation after it is finished.

Hurry up, the coming man, and solve the great problem of threading cities with neat, quick, and comfortable street cars, passing and repassing with undeviating regularity. They will be a boon.

Lincoln, Ill.

Curious Freak of Twin Steam Boilers.

To the Editor of the Scientific American:

Will you allow a constant reader of your paper to lay before your readers the mysterious working of two flue boilers in the packing house of Messrs. Nossingers, Tobey & Co., Kansas City, Mo.?

The boilers are set in brick work, having a partition wall between them, the gases passing off through a sheet iron stack. Each boiler is sixteen feet long and forty inches diameter, with two twelve inch flues. They are connected below by a mud drum, ten feet long and fourteen inches diameter; the stand pipes, connecting mud drum to boilers, are each two feet in length and two inches diameter. Feed water is fed through the check valve at one end of the mud drum communicating to each boiler.

Steam connections between boilers are made of two inch pipe, tapped in, on top of each boiler, three feet from front end, and rise vertically twelve inches to where elbows direct the pipe across and connect the two boilers; from a tee, midway between the boilers, in this pipe, rises another pipe, nine inches in length, and to this the safety valve is attached; the steam pipe then takes its course over the partition wall, leading to engine tanks and elsewhere in the house.

The mysterious working of these boilers is that the same water level cannot be maintained in both boilers. Two, and sometimes three gages of water would fall from one boiler and fill in the other, changing at regular intervals from one boiler to the other.

To bring the return of water in the empty boiler, the furnace and sometimes even the connection doors had to be opened on the empty boiler. Even firing was maintained at all times. The boilers were clean, and driven wells supplied the feed water. Cold feed water was used at times, and even warm and quite hot water at other times, but all to the same effect.

My experience of handling steam boilers of all kinds extends over a period of over ten years, and the working of the boilers in question is a new case with me; and I would wish to have the decision, of older engineers than myself, as to the cause and the remedy for the same, given in your paper.

Two other large packing houses at this place have boilers set in the same manner as above, and at both places a water level in both boilers cannot be maintained.

H. P. S.

Wanted, a Substitute for Whalebone.

To the Editor of the Scientific American:

Allow me to call the attention, of the numerous inventors who read the SCIENTIFIC AMERICAN, to a new article on which to experiment. It is an established fact that whalebone is growing scarcer and higher in price every year, and disasters, like the recent one to the whaling fleet in the Arctic sea, send it up to an enormous price. Whoever will discover a satisfactory substitute for this article has the prospect of large reward. Steel has been used to some extent as a substitute, but it is not satisfactory. Some experiments have been made with rawhide, but the results attained, so far as I know, have not been very successful. The important point to aim at, is to get a substance that has the required degree of elasticity, without liability to break.

New Haven, Conn.

J. H. FOY.

[The above statement is very apropos to our recent editorial on the "Dependence of further Mechanical Progress upon the Discovery of New Materials." We hope our correspondents will make public all such requirements.—EDS.]

Artificial Stone.

To the Editor of the Scientific American:

Feeling, as I do, a vital interest in all improvements, and seeing, in the last number of the SCIENTIFIC AMERICAN, an article on artificial stone which pleased me much, and being qualified to confirm, by experimental and practical experience, its durability, I submit the following:

In the year 1855, I made a piece of flagging, 16 inches by 24, 2 inches thick, in the following way: I made a mold of the above size and filled it with granite stone chips, then with mortar, of Portland cement and coarse sand, equal parts. I floated it off and when set, brushed it over with clear cement and then left it to harden. It is in the street, and subject to the action of frost and carriages, and is as perfect as when first laid.

Ayer, Mass.

ELIJAH MYRICK.

WATERPROOF STARCH is the subject of a French patent, and consists in passing the goods, after being properly starched, through a bath of chloride of zinc at a temperature of about 60° Fahr. The starch will then remain in the clothes after several successive washings.

He who can suppress a moment's anger may prevent days of sorrow.

[For the Scientific American.]
UNITS OF HEAT AND OF FORCE.

As the word unit is so much used at the present day in relation to heat and power, it may be well, for the benefit of some readers not clear on this subject, to give a few words of explanation.

It is evident that the mere mentioning of the temperature of a certain amount of hot water can by no means be considered a measure of the amount of heat consumed to heat the same. Let, for instance, the water in the boiler of the steamer *Westfield*, which recently exploded, and which contained nearly 600 cubic feet or 36,000 pounds of water, be heated to 274° Fahr., so that, to water of 54°, some 220° had been added in order to raise it to the temperature corresponding with a pressure of twenty-seven pounds, by which it is said that it exploded. Then it is evident that these 220° are by no means a measure of the amount of heat given by the furnaces to that boiler, as a single pound may be heated to the same degree, with evidently one 36,000th part of the amount of heat required for the 36,000 pounds; it is therefore, in order to give a correct measure of the amount of heat, necessary to take in account the amount of material which was heated, and it has been agreed to take one pound of water in connection with one degree of Fahrenheit's scale as a unit, and to call a unit of heat that amount of heat required to heat one pound of water one degree. Therefore heating one pound 220° or 220 pounds one degree indicates, in either case, 220 units of heat; but heating 220 pounds 220° indicates 220 × 220 = 48,400 units of heat. And the *Westfield* boiler, if it contained 36,000 pounds of water, diffused by its explosion 220 × 36,000 = 7,920,000 units of heat, in case the pressure was only twenty-seven pounds, and consequently the corresponding heat 274°. The number of pounds of water multiplied with the number of degrees it was heated, gives us a product expressing what is called the number of units of heat.

It is the same with force. A number of pounds alone expresses no force, and it is totally erroneous to speak of a force of say 100 pounds, because when they stand on the floor and are not moving, they are a mere dead weight; but lift them against gravitation, and then you have to exert a force to do this; or let them descend, and they will exert a force themselves, proportional to their amount. But even then the mere mentioning of the number of pounds gives no measure of the force expended or obtained, because it is evident that it takes twice the amount of labor to lift them two feet that it does to lift them one foot; and inversely, it is clear that in descending they will produce an effect proportional to the space they descend. For this reason also here a second element is introduced, the foot, and it has been agreed to accept as a unit the force required to lift one pound of matter one foot high, so lifting 100 pounds one foot or one pound 100 feet is 100 units, and lifting 100 pounds 100 feet high is 10,000 units of force.

To use this as a correct measure, the weight must be lifted so many feet perpendicularly against gravitation, and not be hauled up against an incline of say 100 feet long; one pound moved in this way would not indicate 100 foot pounds, but, in case the raise of the incline was one in ten, only ten foot pounds. Much less must the space of the weight, moved over a horizontal plane, be taken as the measure of distance, as I have once seen done by a school teacher, who, to find the number of foot pounds of the power of a locomotive, multiplied the number of feet the train advanced in a minute by the whole weight of the train, and obtained several billions for the number of foot pounds. This would suggest a few millions of horse power for a single locomotive, and be only correct if the locomotive lifted the whole train perpendicularly upward in the air with the ordinary velocity at which it moves forward. In this forward motion, the force expended is, if there are no inclines, solely expended in overcoming friction and the resistance of the air; and, of course, this may be estimated in foot pounds, but does not compare with the weight and velocity of the train, any more than the velocity of a steamer has anything to do with its weight; its engine only overcomes the resistance the water offers to its progress.

The unit of force has therefore been called the foot pound, and in order to find it, we have only to multiply the number of pounds lifted with the number of feet they are raised. So in regard to the Brooklyn water works, which raise the water 170 feet high, every pound of water has to be multiplied with this number; and every pound of water used by the citizens represents a force of 170 foot pounds spent in the labor to bring it to his dwelling. The engines there throw, every hour, 2,000,000,000 pounds water into the reservoirs, representing a force of 170 × 2,000,000,000 or 340,000,000,000 foot pounds per hour.

It is evident that these standards, of units of heat and force, are arbitrary, and only conventional like other standards of measurement; but they have been of the most eminent service in making researches and experiments positive, and I conclude in stating that the French have adopted similar standards, founded on the decimal and metric system, but which are easily reduced to the American standards. The French unit of heat is one kilogramme water heated one degree of the centigrade scale, and of force, one kilogramme lifted one meter high; and they use in place of our "foot pound" the expression "kilogram-meter." As a kilogramme is nearly 2.205 pounds, and the centigrade degree equal to nine fifths of the Fahrenheit, the French unit of heat is 2.205 × $\frac{9}{5}$ or nearly four times larger than ours; while the French unit of force is $7\frac{1}{2}$ times ours; the meter being 3.3 feet, this, multiplied with the value of the kilogramme in our pounds, 2.205, gives 7.2766 or about 7.28, when more accuracy is required than is obtained by the round number $7\frac{1}{2}$.

New York city.

P. H. VANDER WEYDE.

[For the Scientific American.]

DECAY OF STONE AND BRICK.

BY JOHN C. DEAPER, PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

The rapid disintegration or decay of the brown stone, so generally employed in the construction of New York houses, leads naturally to the consideration of the causes producing this decay, and also to the examination of other building materials, and the discussion of their merits or demerits as compared with brown stone.

- The chief causes of disintegration of stone and brick are:
- 1st. Roughness of surface, favoring the deposition of dust.
 - 2d. Vegetable growths, favored by dust and moisture.
 - 3d. Percolation of water through interstices and fissures.
 - 4th. Action of frost.
 - 5th. Action of acid vapors in the air.

In the experiments we propose to relate, the materials employed were the same as those mentioned in a previous paper, namely, brown stone, Nova Scotia stone, red brick, and white brick. Submitting these to a microscopic examination under a power of twenty-five or thirty diameters, a very instructive lesson regarding the structure of these materials is obtained. The stone is seen to be composed of various sized particles loosely aggregated together, and presenting a very rough surface; the red brick is smooth, the fracture showing interstices of considerable size, while the white brick is not only smooth, but also dense, the interstices being very small; and every here and there minute spheres of molten glassy material are discoverable, showing the intense heat to which the brick has been subjected. Such a microscopic examination affords, to the architect and engineer, indications regarding the probable weathering power, which should never be overlooked in the selection of building material to be used in exposed locations, for the rough imperfectly cemented material not only favors the deposition of dust, which, being chiefly organic, furnishes a suitable nidus for vegetable growths, but it is also, by virtue of its structure, more friable, and therefore easily disintegrated by the forces to be considered hereafter.

The vegetable growth, of which we have spoken above, is a minute lichen, known as *Lepa antiquitatis*, and it grows with remarkable freedom on such hygroscopic rocks as the sandstones, as any one may satisfy himself on examining the houses on the cross, or east and west, streets of our city.

The percolation or passage of water takes place even in the densest rocks, as trap and basalt, for, in the interior of even the most compact specimens of these rocks, spots of moisture are often found on breaking them, and Bischoff states that these are always connected with minute fissures, the edges of which often show effervescence when they are touched with acid, thereby demonstrating that water may convey into, or produce, carbonates, even in these dense rocks, and thereby alter their structure. This being the case with compact rock, we can form some idea of the manner in which percolating water acts on such loosely cemented material as the different kinds of sandstone.

Of the agents engaged in the disintegration of rock, one of the most efficient is frost. In its action, two elements are involved, namely, the friability of the material and its hygroscopic power. The difficulty attending the direct application of cold in the examination of the action of frost, has led to the use of other and similar means. Among these none is better adapted for the purpose in view than that of dipping the material to be examined in a saturated solution of sulphate of soda, and allowing the salt to crystallize when the specimen has been thoroughly saturated with the saline solution. The crystallization of the sulphate of soda, on and in the substance, brings to bear upon its particles the same kind of force as that produced in the crystallization or freezing of water, and particles are torn off or separated exactly as in the latter operation. In employing this test I soaked the rock in the solution for about four hours, and let it dry and crystallize for twenty hours. The loosened material was washed off by a fine jet of water from a washing bottle, the sample redipped for four hours, and again set to crystallize. This was repeated eight times, the experiment extending over a period of eight days, with the following results:

TABLE I.

Brown stone	10,000 parts, lost 191 of substance.
Nova Scotia stone	" " 441 "
Red brick	" " 74 "
White brick	" " 24 "

The disintegration is very nearly in the ratio of 1 for the white brick, 3 for the red, 3 for the Nova Scotia stone, and 18 for the brown stone, a result which furnishes information of the greatest value from an economic point of view, and which cannot be too strongly insisted upon in a country where so little attention is paid to the durability of public and private edifices.

The long periods of time, required for the performance of the crystallization test, led me to make a series of experiments to find a quicker method for arriving at a reliable determination of the friability of these substances. The plan I endeavored to apply was to heat the specimens to a temperature of about 600° Fah., and then quench them while hot in cold water. The sudden chill and formation of steam on the surface of the masses caused them to disintegrate superficially, the amount of material removed, after the repetitions of the chill, being:

TABLE II.

Brown stone	10,000 parts, lost 202 parts of substance.
Nova Scotia stone	" " 597 "
Red brick	" " 82 "
White brick	" " 43 "

which gives a ratio of 1 for the white brick, 2 for the red, 5 for the brown stone, and 14 for the Nova Scotia. These re-

sults do not agree exactly with those given by the sulphate of soda test, but they approach them more closely than could have been expected considering the different character of the force applied.

Though the chilling test described above may be objected to as not meeting the conditions prevailing during the action of frost, but being rather the opposite, on account of the employment of heat in place of cold, it gives results which are very significant when viewed in relation to the power of brick and stone to resist the destroying action of great conflagrations. The conditions of the experiment are almost identical with those presented by a building on fire, for in each case the substance is alternately heated by the flames and chilled by the water thrown to quench them. The table therefore gives a very fair estimate of the relative powers of the materials in question to resist such destructive action.

The chemical ingredients of the air that act on building materials are carbonic, nitric, sulphuric, and sulphurous acids. The first of these is always present as the product of combustion, and, when dissolved in rain water, forms a solution which readily dissolves marble and other limestones, and even acts on dense granite and other rocks. Sulphuric and sulphurous acids are both found in appreciable quantity in the air of all localities where coal is used as fuel. Nitric acid is, in its turn, at times an ingredient of the air, especially after great displays of lightning; it also is produced under certain conditions during the decomposition of organic matter containing nitrogen. To determine the action of these acids on the materials with which I was experimenting, I placed portions of them in dilute nitric acid, and left them in contact with the liquid for two weeks. I then kept them in water for ten days, changing the water every day to insure the removal of all soluble material; they were then dried, and being weighed, gave the following results:

TABLE III.

Brown stone	10,000 parts, lost 214 parts of substance.
Nova Scotia stone	" " 66 "
Red brick	" " 33 "
White brick	" " 7 "

In which the ratio of disintegration is 1 for the white brick, 5 for the red, 9 for the Nova Scotia stone, and 30 for the brown stone. From this it would appear that the reason the brown stone disintegrates so rapidly in our city is its greater susceptibility to the action of the acid products of organic decomposition and combustion, where the cementing material is dissolved or weakened, and pores and fissures in the rock being opened, it is less able to resist the attack of frost. The Nova Scotia stone, on the contrary, is a more friable material than the brown stone; yet being less acted upon by the acid waters, it resists the process of decay better. The superiority of the white over the red brick, in this respect, is even more marked than under the other tests, and, taken with them, gives unquestionable evidence of the weather resisting power of this hard burned compact brick.

[NOTE.—In our article on this subject last week, an error appeared in Table I, in part of our impression only. The loss of moisture of Nova Scotia stone should have been printed as 426, instead of 260.—EDS.]

OCCASIONAL NOTES.

By G. E. H.

Amsterdam, 1871.

THE GREAT SHIP CANALS OF HOLLAND.

Previous to the completion of the great North Holland Canal, the larger vessels of the Amsterdam trade were obliged to discharge their cargoes outside of the Amsterdam harbor, and were themselves lifted over the bar, at the mouth of the IJ, by means of large "camels," first sunk on either side of the ship, and then rendered buoyant by pumping the water from them by hand pumps; but, in 1825, the opening of the canal, and the improvements of the harbor, afforded a safe sea channel for the largest East Indian, avoiding both the delays at the bar, and the difficult and dangerous navigation of the Zuider Zee.

The harbor then was reclaimed from the south bank of the IJ, and consists of two immense dykes or dams, nearly parallel with the quay front, which likewise serves the additional purpose of protecting the town from inundation. Between the two dykes extend two rows of immense piles, with openings left at intervals between them, to allow the passage of ships, which openings are uniformly closed at sundown by large booms.

To reach the North Sea, vessels pass westerly along the channel of the IJ into the Wyker Meer, and thence through the canal proper to the Helder, a distance of 51 miles.

The engineering of this wonderful work of utility, which is 124 feet wide at its surface, and 21 feet deep, overcame enormous difficulties in its construction through the low swamps and loose sands of North Holland; while, to secure a safe foundation for the locks, (which are the largest known) excavations, 43 feet below the present surface of the sand, were necessary. This work occupied Blanken, the engineer, six years, and had cost, when opened, \$7,500,000.

Still more to facilitate her commercial relations, Amsterdam is at present constructing a new and more direct route to the sea, which shall not only shorten the distance by 35 miles, but also add to the many acres already reclaimed from watery dominion. This work, to be called the Great North Sea Canal and Harbor of Refuge, is under the direction of Mr. Hawkshaw and Mynheer Dyrks, and was commenced in 1867, with the then expectancy of completing it in 1876. To Mr. Hutton, the resident engineer, our thanks are due for his kind attentions and information concerning its details.

The scheme commences by throwing an immense dam across the harbor, at the junction of the Pampus with the IJ, founded in a lake of mud on 10,000 of the longest piles. This

dam, provided with immense sluices to pass vessels and keep out the Zuider Zee, was formally opened some ten days previous to this writing.

Westerly from the city, extends the canal, which is formed, not by excavation, but by enclosing a riband of the IJ between two large parallel dykes, 250 feet apart; and founded, as the harbor dam is, upon piles driven deep into the muddy bed, near the northerly bank. Through the peninsula of Buitenhuisen, the canal is excavated, but enclosed again by dykes across the Wyker Meer, with suitable branches, to accommodate Halfweg, Haarlem, and the North Holland Canal. All of the watery space not enclosed is to be drained for agricultural purposes, and the sale of the reclaimed lands will largely provide funds toward the cost of the works.

From Velzen, the canal is being excavated directly west through the sand dunes, to the North Sea, where the Harbor of Refuge is about half completed. This is to be entirely formed by throwing out from the beach, two piers, each 5,000 feet in length, of heavy blocks of concrete. These piers, which approach each other at the sea extremity, enclose 250 acres of secure anchorage, of which area 150 will be dredged to a uniform depth of 26 feet. Half a mile inward from the beach are being finished the extensive sluices, while the intervening distance to the harbor will form a tidal basin, 26 feet deep, and 197 in surface width.

The lock foundations are formed of huge concrete blocks, similar to those employed in the piers, and are finished in Dutch brick and ashlar.

For the piers, the blocks average seven tons in weight, and are manufactured, by a system of Mr. Hutton's, at Velzen. They are transported to the harbor by rail, and transferred from the car to the sea bottom, by an ingenious steam crane, designed by the same gentleman.

Divers are employed to see that each stone is properly bedded, and they give the signals to the crane driver by means of a cord to the boat. The parapet blocks, of from 50 to 60 tons weight, are, of course, moulded *in situ*.

To get a definite idea of this vast work, one must watch the varied labors combined in the construction of this immense undertaking. He must observe the long sand trains puffing their way, from the lower excavations, at the locks, up the heavy grades toward Velzen, there to deposit their loads along the slowly forming dykes of the Wyker Meer, passing, *en route*, the little locomotives on the bank, conveying their trains of trucks, each carrying its heavy concrete block to form a unit in the long piers that stretch their protecting arms far into the stormy waters of the North Sea.

Add to this the steam mixers and transferring cranes at Velzen, the steam dredgers, and the interminable gangs of "navvies" along the canal, and the colossal nature of such an undertaking is far better understood than by the medium of a hasty pen.

Earing's Improvement in Saws.

The object of the present invention is to provide means for smoothing the sides of shingle heading or lumber as such articles are sawed. To this end the saw is supplied with cutting knives and knife sections.

The saw teeth are made thinner than the knife plates. The cutting sections consists of one or more knives which have chisel edges, and there are two knives to a section, with the edges reversed, so that they cut upon each side of the saw kerf as the saw passes through the timber, thus smoothing the sides of the articles manufactured. The upper points of the cutters are slightly below the points of the saw teeth, and the lower points are supported by shoulders. The saw teeth are set or swaged so that their points are a trifle less in thickness than the knife plates, thus giving the teeth clearance, thereby diminishing the friction. The knives and their teeth thus placed will, it is claimed, cut a less kerf than any saw now used of the same thickness of the knife plates, thereby effecting a material saving in lumber. The number of sections depends upon the diameter of the saw.

Mr. William L. Earing, of Oswego, N. Y., is the inventor of this improvement.

Tapioca Paper.

To prepare tapioca paper, says the *Engineer*, which is very useful for copying photographs by artificial light, 200 grammes of tapioca are soaked for two days in an equal weight of water; ten litres of water are added, and afterwards, for every liter of liquid, ten grammes iodide of potassium, thirty grammes chloride of potassium, one gramme bromide of potassium, are dissolved, and the whole boiled for ten minutes, allowed to stand for a day, and decanted and filtered through fine linen. The paper is immersed, twelve or twenty sheets at a time—or can be floated upon it—for fifteen to twenty minutes; it is then hung up to dry in a dark room. If it has assumed a dark color, that is of no consequence, as it disappears in the silver bath. This is to be prepared in the proportion of 1-15, and for every ounce of nitrate of silver, fifty to sixty grains of citric acid in 30 ounces of water. The time of exposure varies from ten seconds to twenty-five minutes, according to the picture to be copied and the actinic force of the light.

TO CLEAN PETROLEUM LAMPS.—Wash the vessel with thin milk of lime, which forms an emulsion with the petroleum, and removes every trace of it, and by washing a second time with milk of lime and a small quantity of chloride of lime, even the smell may be so completely removed as to render the vessel thus cleansed fit for keeping beer in. If the milk of lime be used warm, instead of cold, the operation is rendered much shorter.

A KNOWLEDGE of our weakness creates in us charity for others.

Cone Winder for Knitting Machines.

This invention has for its object the rewinding of the yarn as it comes from the spinning jack bobbin or cop preparatory to knitting, and is capable of winding the yarn from one 250 spindle jack. Its simplicity is its great and first noticeable feature, as it works without gearing, and at the same time allows each bobbin to act independently of its neighbor, so that an empty bobbin can be put on between two that are nearly full, or *eice versa*, and each bobbin is completely formed and filled automatically.

It has long been claimed by experienced knitters, that if a winder could be made to do its work perfectly, at least one half the trouble and labor necessary to produce a good quality of knit cloth would be avoided. This, the inventor claims, is accomplished by this cone winder.

The essence of the improvement consists in so mounting the bobbins relatively to the cones or shell winders, and pressing them thereon by adjustable weights, that any required density may be given to the bobbin.

The bobbins, A, are placed on the horizontal axes, B, which rotate in fixed boxes or bearings in the frame, C. Motion is given to the bobbins by belts from the main drum to splined pulleys—not shown—on the several axes; consequently the pressure of the bobbins against the cones is independent of the tension of the belt.

But at the rear end of each axis, B, there is a weighted lever—not shown—constantly pressing against the axis to hold the bobbin against the cone, and these weights are made adjustable, so that any required pressure can be produced.

The cones or shells, D, are mounted on axes working in pivoted bearings, and are controlled by the levers, E, so that when a bobbin is completed, the cone may be tilted downward out of the way by the operator, as shown in the engraving.

The cops, F, as they come from the jack, are mounted on spindles above the bobbins, and the yarn or thread, as it unwinds from the cop, receives first an adjustable tension, which insures a firm body to the bobbin, and also causes any slack twisted spot to part, so that it can be mended before it is taken to the knitters. From the tension it passes through a variable gage or stripper, which cleans off the seeds, snarls, or unequal sizes of yarn, and from this it runs on to the bobbin, being guided by a quickly moving traversing bar or rod, so crossing and recrossing the thread that it is barely possible for two circles or a double thread to run off while knitting. Each bobbin holds about 22 cops, which will supply a knitting feed for about one hour.

More than one hundred of such machines have gone into use since the issue of the patent. Any further information can be had by addressing the manufacturer, Clark Tompkins, Troy, N. Y.

Body Loop for Carriages.

The improvement represented in the annexed engravings overcomes a defect in carriages, which is, we believe, well understood by all who use them.

There is nothing more uncomely in appearance than a carriage, otherwise in good condition, or which could be made so by a fresh coat of paint, with its springs leaning back or forward. This leaning is caused by looseness from wear of the spring bolts, connecting the ends of the springs, or by other causes, the ordinary fastening of the body loops and spring bars being insufficient to retain the parts in their original position.

The angular position of the spring also introduces a different and injurious strain upon portions of the running gear, the weight of the carriage body and its load being then carried beyond the centers of support of the axles.

The body loops represented in Fig. 1, 2, and 3, are of different patterns, Figs. 1 and 2 having a projection or lip in front of the spring bar, and Fig. 3 in the rear of the same. The plate, D, represented in Fig. 4, is extended into a bolt which passes through a slotted hole, E, in the lower end of the projection of the body loop, which plate, D, in the operation of securing the body loop and the spring bar together, is capable of adapting itself freely to the bottom surface of the spring bar, and also to follow up whatever compression the wooden spring bar may be subjected to in the act of bolting the parts together; after which the plate, D, is firmly secured to the body loop. In this way each body loop is converted into a brace for the running gear.

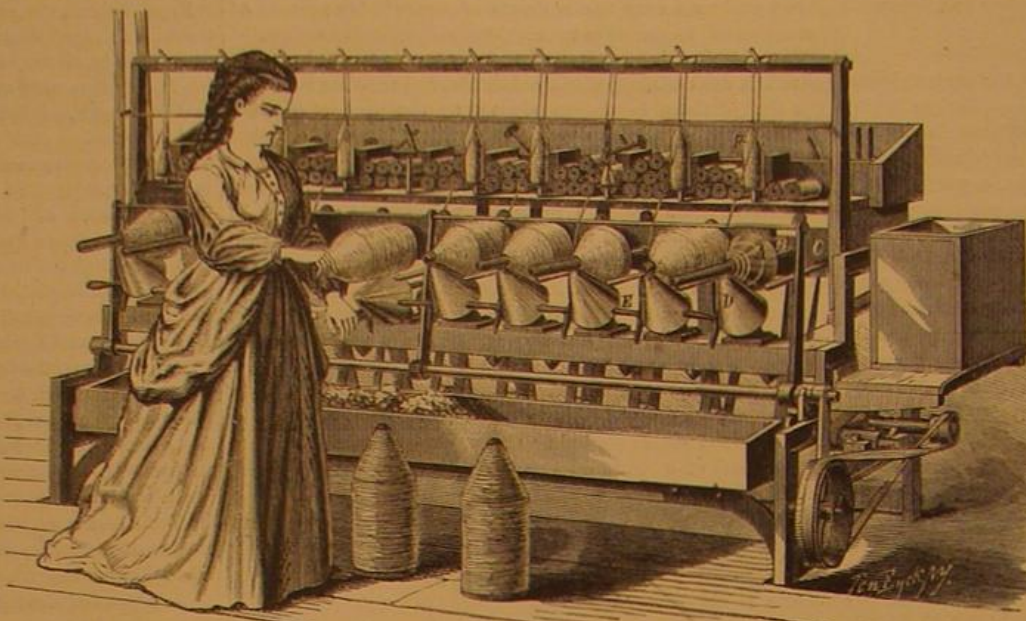
This improvement, we are told, has been practically tested on a carriage, which has been in daily use for more than 18 months, and has traveled in that time about 4,000 miles (partly over very hilly ground with "breaks" to turn the water), the load often amounting to from 300 to 400 lbs. weight, the whole running gear being preserved thereby in the same

rigid condition as at first. The improvement was patented on October 5, 1871, and is the invention of Mr. H. A. Luttgens, of Paterson, N. J., who may be addressed for further information.

Improvement in the Manufacture of Picks and Rammers.

This invention, of Mr. Daniel McNally, of Mount Savage, Md., consists in reinforcing the eyes of such tools as are liable to split in the direction of the laminations or grain of the metal, as hereinafter described.

The rammer used upon railroads has more particularly been found to split or break lengthwise. After careful

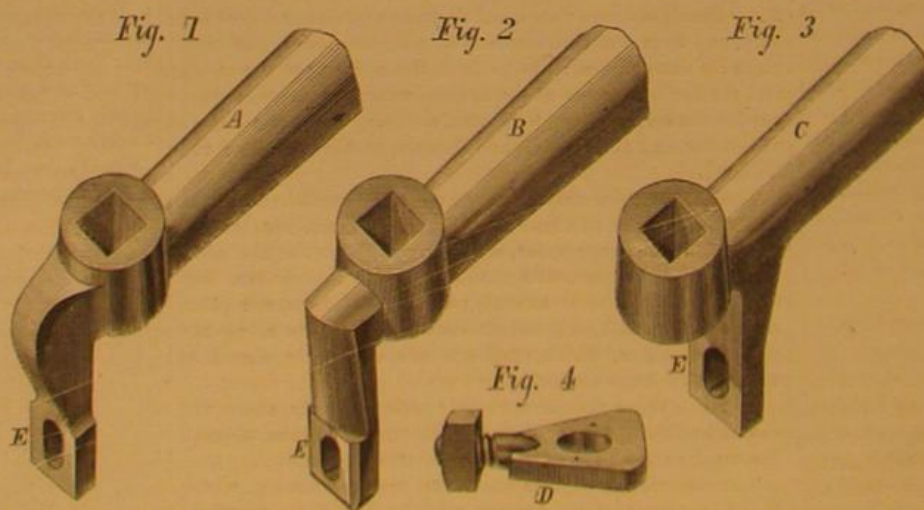
**TOMPKINS' CONE WINDER FOR KNITTING MACHINES.**

thought and experiment, the inventor claims to have discovered a new method of effecting this object. The opening in the bar iron for the eye of a rammer having been formed in the usual way, he punches one hole a little above and another a little below it, but transversely thereto, and across the grain of the metal. These holes are preferably extended not quite through the blank. He then takes wedges of flat bar iron and places them in these apertures, with the grain at right angles to that of the blank, and welds the two firmly together. The eye is then finished on a mandrel or in any other suitable way, and, if desired, is then chamfered to an elongated edge at top and bottom.

This method of reinforcing the eyes of picks, rammers, and analogous articles by welding a transverse piece of metal above and a like piece below each eye, and with its grain across that of said articles, as described, constitutes the improvement covered by a single broad claim allowed in Mr. McNally's patent.

Machine for Shrinking Hat Bodies.

This invention relates to improvements in machines for shrinking or fitting the bats or thick masses of fiber of which the hat bodies are made. It consists in a grooved roller, mounted in the upper part of a vat above a series of other smaller rollers, for passing the bodies through to subject

**LUTTGEN'S BODY LOOP FOR CARRIAGES.**

them to pressure, the said grooved roller being suspended by springs in housings adapted to allow it to rise and fall, and connected by other springs to pressure regulating lines, and the lower rollers having an endless apron working on them and suitable guide rollers to facilitate the carrying of the bodies between them and the upper roller, which said apron may be dispensed with in some cases, the lower rollers being arranged to conduct the bodies to the entering point between the upper and lower ones.

The hat bodies, which are in the form of bats or laps of loose wool fiber laid together on a former much larger than the finished hat, are placed in the hot water in packs between cloth, and passed between the rollers, which it is claimed felt the fibers together and shrink them down to the density and size required much better and with less labor than is done by the common process of shrinking them by hand.

The grooved roller is very effective in working the fibers together on account of the alternate action of the grooves and ribs in pressing upon parts of the surface, while other parts are free, having a tendency to move the fibers on each other much like the action of the ordinary jigger employed for condensing laps into felt cloth.

Peter V. W. Bishop of Morristown, N. J., assignor to himself and Jephtha W. Dunn, of Newark, N. J., is the inventor of this improvement.

Improvement in the Preparation of Mortars and Cements.

Henry Young Darracot Scott, of Ealing, Eng., has just patented, through the Scientific American Patent Agency, improvements in the preparation of mortar, cement, bricks, blocks, artificial stone, and other articles, from quicklime, clay and calcareous shales, for building purposes.

The first part of the invention consists in mixing or dissolving sulphate of lime or other caustic sulphate, in the water used for mixing the ingredients composing the mortar or cement. The water and sulphate are first mixed and quicklime added till a pasty mass is formed, when sand may be used to give it a proper body. The mortar or cement thus obtained is termed "selenitic slip."

The following are the proportions of the several ingredients used in preparing the mortar for ordinary building purposes, namely, sulphate of lime, one fifteenth part by measure, to one fiftieth part of quicklime, and four, five, or six parts of coarse sand. Hair, Portland or Roman cement, calcareous shale or marl, puzzolana, sand, shingle, and screened ballast, or water, one or more, are added in proportions to suit the other different purposes for which the cement is designed to be used.

The second part of the invention relates to an improved method of producing a hydraulic cement from quicklime, clay, shales, and other substances. This part of the invention, like the former, is based upon the action of sulphates or sulphuric acid on lime. In making hydraulic cement, the inventor uses of quicklime sixty-seven parts by weight; of fine unctuous clay, thirty parts; and of plaster of Paris, or other cheap and soluble or partially soluble sulphate, such as sulphate of iron, or of sulphuric acid, three parts. Of the lime and sulphate he proceeds, as in the former instance, to make a selenitic slip, and after adding the clay and grinding together the ingredients into a homogeneous mass with about sufficient water to bring the resultant compound into the consistency of stiffish mortar, the mixture is removed from the mill. As only sufficient water has been employed to insure the proper admixture of the ingredients, the mass will shortly begin to set, and will soon become stiff enough to enable it to be made into bricks or balls; or it may be spread on the floor of a drying chamber and dried. It is believed that the quick setting property of the mixture is due to the peculiar action of the sulphate upon the quicklime in the compound. By taking advantage of this rapid setting property, and by making the mixture of the lime and clay in the manner described, the inventor claims that he can produce artificial cements much more speedily and economically than by the present system. The bricks or blocks thus formed are then stacked for drying. They are subsequently burnt in any suitable form of kiln, either as bricks are usually burned, or the lump may be burned as lime is burned. The temperature of the kiln must be so regulated as to bring the silex in the clay into the condition in which it can unite freely with the lime, care being taken that the heat is not too great.

Needles.

There is a needle factory in New Haven where the whole process is done by a single machine, without the manual labor of any person. A coil of steel wire is put in. The machine cuts it off at the required lengths. It cuts the steel pieces consecutively, punches the eye holes, countersinks the eyes, and grinds the points, and, in fact, does everything until the needles drop out completely formed. Another machine picks them up and arranges them heads and points together, and a third piece of mechanism puts them into paper. One of these machines occupies no more space than an ordinary table; each of them turns out from 30,000 to 40,000 per day. Most of the needles hitherto in use have been imported from England until a few years past. They are made there mainly at Redditch, in Worcestershire. The business employs about 4,000 people, chiefly females. The workers are paid from 36 cents for small children to \$9.50 for skilled men, weekly.

RAIN and snow storms travel from the west towards the east in the United States, during the months of November, December, January, February, and March.

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TOO MUCH GAS; NOT ENOUGH LIGHT.

The various companies who furnish illuminating gas to the citizens of New York appear to think that it is gas that we want, and not light. We have plenty of the former, at any rate we pay for enough, but somehow, in cold weather, the light becomes "small by degrees and beautifully less." If there ever was an absurdity, it is paying for gas by the cubic foot instead of by the volume of light it affords. What we want is light, and that is the article we ought to pay for, and the only correct measure is the photometer, not the gas meter. In every other country but this, there is an inspector appointed whose duty it is to report upon the candle power of the gas furnished by the companies; and, if it is found to be below the prescribed standard, the delinquent company is compelled to pay a heavy fine. In London, the gas inspector is a thoroughly competent man, appointed by the Government, and beyond the reach of the companies. He takes hold of the work fearlessly, and the consequence is that in that city the candle power of the gas is very much higher than with us. Some of the London companies take pride in keeping their gas up to fifteen candles, which is the maximum required of them. It is possible to make a gas of twenty-one candle power, but we could not consume it in an ordinary burner or under the usual pressure; it would be apt to smoke. The more dilute the gas is, the more readily it will pass through any given aperture; hence a gas of a very low specific gravity will rapidly run up a high score on the meter without affording any compensation in the amount of light.

If gas is to be sold by the cubic foot, then the company may pump in a quantity of atmospheric air, or let it consist of fifty per cent hydrogen, or make it of a low grade on purpose. As long as they contract to furnish gas and not light, they are at liberty to speculate as much as they please; the lapse is largely our own for not agreeing with them to give us light, and not gas.

Now that there is every prospect of a reform in many things, we propose that this question be also submitted for discussion. All we want is to have a gas of a fixed and known candle power, to have an inspector appointed to control the manufacture, and heavy penalties attached for any breach of the law; precisely as it is in London, where the whole business has long since been reduced to a system, and frauds have rarely been detected. There are certain circumstances under which the companies ought to have some indulgence shown them, for example: sudden changes in the temperature cannot be anticipated, and they affect the illuminating power of the gas in a very marked ratio.

It has been found that the amount of light emitted at 32° Fahr., is 25 per cent less than at 65° Fahr., and at 4° above zero, it is 70 per cent less than at 65° Fahr. On the other hand, increased heat is not accompanied by a corresponding amount of light, since the temperature of boiling water causes an increase of 4 per cent over the standard, and that of 320°, only 18 per cent. The loss of illuminating power is due to the condensation of hydrocarbons, which are gaseous at ordinary temperatures, but become solid in the cold. When the companies anticipate a cold snap, they manufacture a richer gas, which will bear this condensation without too great a loss in illuminating power.

The gas companies always have competent chemists, either

directly in their employ, or retained for consultation; and they know how to furnish light with gas, instead of gas without light, as soon as it is made their interest to do so. As the law now stands, there would appear to be no remedy but to quietly submit, or take it out in grumbling; in the meantime, it would be well to revive the excellent bill drawn up last winter under the auspices of the Board of Health, and put it on its passage as soon as the Legislature comes together. If that bill did not contain a proviso for the inspection of gas meters, it would be well to have it inserted, as the companies furnish their own meters, and the consumer cannot know that they give correct tally until he is so assured by the authorized inspector. It is a common observation at the present time, that persons who are compelled to work at night soon complain of weak eyes and defective vision.

Many students are disabled and obliged to abandon their studies, while others have substituted kerosene oil for gas. There is no doubt that poor gas has much influence in this increasing infirmity, and this fact affords another argument in favor of a change. According to the *American Gas Light Journal*, more than one hundred million cubic feet of gas are made every month in the city of New York. As the quality of coal used is manifestly very poor, the yield does not probably exceed six or seven thousand cubic feet; but even this inferior coal involves the distillation of about 17,000 tons a month, or over 200,000 tons a year. It is probable that, under proper legislation, the companies will be compelled to manufacture a gas practically worth one quarter more than they now furnish to consumers; and, as the annual amount paid to all of the gas companies in New York cannot vary very much from five million dollars, it follows that the community is at least one million dollars short in this transaction. It seems hardly credible that these figures can be correct, and yet they are based on the best information that we can obtain. They are so large that, even with a discount of fifty per cent, they show how imperative is the necessity for reform in a matter in which the whole population is interested. We repeat what we said in the outset, that we have too much gas and not enough light.

PROGRESS OF THE UNDERGROUND RAILWAY SYSTEM.

While the people of New York city have been threatened with the complete disfigurement of their beautiful city by a viaduct railway of unparalleled costliness and repulsive appearance, the inhabitants of Paris are promised a most convenient mode of transit along the main thoroughfares, which will unite all the railway termini to one central depot, and also make two connections with the Belt Railway (*Chemin de Fer de Ceinture*). The tunnel or underground system will be adopted in the work.

There is no need to say much more in favor of this mode of construction. The subject has been exhausted in the public journals, as well as by the more convincing arguments of actual experiment on the largest scale, in London, Detroit, Chicago and other cities. The Metropolitan Railway of London affords the best illustration of what is wanted in New York, and points out the most ready and economical means for its achievement.

By making a tunnel along the public highways, the cost of the land and the more expensive item of compensation to occupants is reduced to a minimum. Add to these most important considerations, the fact that the traffic already lies in the very direction your subterranean road will take, and you need say little more to convince the public of the merits of the underground system. The large majority of the opponents of the tunnel railways will be found to consist of real estate speculators, jobbers, men with axes to grind to the detriment of the public grindstone, and the large class of local politicians whose interests lie in the total abnegation of economy and convenience. The proposed railway in Paris, as will be seen in an article on another page, will follow the course of the great thoroughfare of Paris, the Champs Elysées and the Rue de Rivoli. By it, not only will rapid transit from one end of the city to the other be obtainable, but a complete union of all the depots of the main railway lines of France will be accomplished.

There is now some hope for New Yorkers that the viaduct railway, the largest and most hideous job of the almost demolished Ring, will not be constructed. More millions of dollars than we can now reckon will be saved to the people if this imminent calamity can be averted. The Parisian company comes before the public with no other demand than the recognition of the merits of the project, and disdains to ask for pecuniary aid, either from the government, the department, or the city authorities. As all works of such vital social importance should, the Metropolitan Railway of Paris stands solely on its merits as a much needed convenience to the business world, and relies, for a dividend on its capital, on the patronage of the traveling public. And the precedent of London indicates that this is not a chimerical or visionary support to which to trust. The wants of all classes concerned are surely satisfied when a thousand trains a day run in each direction, when people are conveyed four miles in fifteen minutes, with convenient stoppages, for two cents a head, and an average dividend of six per cent is returned to the stock holders.

The citizens of New York have just broken the political power of one of the most powerful combinations against liberty and private rights that ever existed in the world. Surely the same people can throw off such burdens as the viaduct railway, with its monstrous bridges, its destruction of buildings, and its trains running in full view of the horses in the thoroughfares, and substitute a cheap, convenient, and accessible road, made for the use of the public, and trusting to its usefulness and efficiency for a profit to its proprietors.

AN EXACT METHOD OF DETERMINING THE EVAPORATIVE EFFICIENCY OF STEAMBOILERS.

At the late Fair of the American Institute in this city, there were entered for competition the Allen, the Phlegel, the Low, and the Root steam boilers, and a smaller boiler of the Blanchard design.

The Committee of Judges on steam engines and boilers being very desirous of making a trustworthy test, the Board of Managers, with commendable liberality, authorized the considerable expenditure of Institute funds which the proposed method of trial necessitated, and the series of tests has, during the last week, been concluded.

The usual method of testing steam boilers has been simply to determine the quantity of water passing through the boiler and the amount of fuel consumed during a given time, and to state the ratio of these quantities as the evaporative efficiency of the boiler. It is, however, evident that, unless the steam leaves the boiler unmistakably superheated, there is no certainty that a part, and a large proportion, perhaps, of the water may not have been carried over unevaporated, and we know how frequently ignorant or dishonest steam boiler vendors have imposed, upon uninformed purchasers, stories of fourteen, fifteen, or even more pounds of water evaporated by the pound of fuel in their very economical (!) boilers.

With a view to ascertaining accurately the relative performance of the boilers offered for trial, and at the same time giving honest and intelligent builders a weapon with which to meet such competitors as are above referred to, the Committee of Judges, Messrs. Thurston, Sloan, and Weir, caused to be built a large surface condenser of about 1,100 square feet of condensing surface, and with meters attached to measure the amount of condensing water.

The steam was delivered into this condenser from the boiler, where the pressure was, as nearly as possible, seventy-five pounds per square inch.

The trial of each boiler was twelve hours long. Steam was raised with wood to a pressure of seventy-five pounds, when the exhibitor was allowed to use coal and the trial was formally begun. The feed was measured by a meter, the water of condensation was weighed on a carefully adjusted platform scale, and the temperatures of feed, steam, water of condensation, injection and discharge of condensing water, and of the temperature of flues were all carefully recorded by selected students of the Stevens Institute of Technology, under the direction of Professor Thurston, chairman of the committee.

The quantity of heat carried off by the condensing water being known, and the quantity of water of condensation, it becomes an easy matter to determine the quantity of heat transferred to the tank by each pound of the latter, and thus to determine precisely its condition, and if wet, the amount of water brought over unevaporated.

The publication of the report will be anticipated with great interest by engineers. It is only known that the results are quite creditable to the exhibitors, and indicate that persons claiming an economy much superior to about ten pounds evaporated from 212° Fahr. by the pound of combustible may be looked upon by purchasers with great suspicion.

CONCRETE BUILDING.

The recent fire in Chicago has called forth a general discussion on the subject of fireproof building and building in general, and although we have said much at different times on the subject of concrete building, the present seems a favorable opportunity for calling our reader's attention again to this important subject.

Slowly but surely, in spite of many failures on the part of experimenters, is the truth becoming established that artificial stone can be made as durable as most natural stones. There have been many humbugs practiced, but these, though they have hindered progress, have not totally checked it. The artificial stones made by the Sorel, Frear, and Ransome processes, and those made with Portland cement, are all good, reliable stones. Of these, however, only the latter can be used *in situ* for concrete walls, and it is of the latter that we propose to speak more particularly in this article.

The erection of concrete buildings, or at least partially concrete buildings, promises, we think, a complete solution of the problem of cheap building for working men. Of all materials we know of, none compares with good Portland cement for this purpose. It has proved its value in extensive works in Europe, where, in addition to the usual effects of weather, it has had to endure the constant action of sea water. It hardens perfectly in a few hours, and forms with sand a concrete rivaling, in hardness and compactness, the best building stones in use. It can, by the addition of coloring matters, be given tints resembling brown sandstone or Nova Scotia stone, while it is far more durable than either. It is much cheaper than bricks and mortar, and can be easily molded in ornamental forms. It possesses far greater strength than ordinary brick work, and looks better when finished. It is as well adapted to inside as outside work, and may be wrought into floors and partitions. It is incombustible and as impervious to water as any stone in use.

With all these advantages, it is steadily making progress against prejudice, and we have not the slightest doubt that it is destined to a far greater popularity in the future than it enjoys at present.

This cement unites readily with sharp clear sand, gravel, broken bricks, pebbles, cinders, etc.; and hydraulic limes may, in some climates, be economically used in connection with it.

To erect buildings of this concrete requires only the skilled labor necessary to place properly the frames, in which

the concrete is molded, and the frames of doors and windows. For warehouses, it admits of the use of iron for pillars and braces, while everything else, floors, partitions, ceilings, etc., may be of concrete. It is estimated by an expert of this city that 100 cubic feet of Portland cement concrete wall can be constructed for \$22-75.

If plastering is used on interior walls, only one coat is required, so that this item of cost is considerably lessened.

For sidewalks this cement also furnishes a cheap and beautiful material, which can be formed in blocks on the spot, presenting a perfectly uniform surface, rivaled only by cut stone.

The rebuilding of Chicago furnishes an admirable field for the employment of concrete; and we trust that, as economy must be perforce consulted, our Western friends will be induced to turn their attention to the system, as it offers advantages possessed, as we believe, by no other.

DR. DRAPER'S EXPERIMENTS WITH BRICK AND STONE.

We desire to call special attention to an article, published in our last, which is followed by a second, in our present issue, from the pen of Dr. John C. Draper, on the absorption of moisture by brick and stone. His experiments will show that bricks, properly compounded and burned, are really superior to many kinds of natural stone for building purposes.

A brick is an artificial stone, homogeneous and without cleavage. It may be made so as to absorb less moisture than many varieties of stone in popular use.

The experiments conducted by Dr. Draper were made with brown stone, Nova Scotia stone, fine red Philadelphia bricks, and a white, or rather cream colored, brick, made by A. Hall & Sons, of Perth Amboy, N. J. A specimen of the latter now lies on our table, and is undoubtedly one of the best building bricks ever produced in this country.

In color it is soft, yet brilliant, its tint being very agreeable to the eye. In texture it is dense and hard, ringing with a clear bell-like sound when struck, and chipping more like dense, hard stone than like the ordinary bricks in market. With granite or blue stone trimmings, these bricks would produce a beautiful architectural effect for fronts, in our opinion far superior to the somber appearance of the brown stone, now so much in vogue, and which is undoubtedly one of the least durable of building stones in use.

Even ordinary bricks will endure our climate better than brown stone, as will appear upon an examination of buildings constructed of bricks with brown stone fronts. In such buildings, that have been erected for a considerable time, it will be found that the fronts are the first parts to become dilapidated, the surface becoming disintegrated and peeling off.

Nova Scotia stone is, perhaps, not much better, in this respect, than brown stone.

The senior member of the firm of Hall & Sons has, perhaps, as extensive theoretical and practical knowledge of brickmaking as any one in the country, and this journal has been enriched by his contributions upon this important subject. The result of the application of this knowledge, and the use of a very excellent article of clay, has enabled his firm to produce the bricks alluded to.

In conclusion, we would say that any who have any doubt as to the superiority of brick over the brown stone and Nova Scotia stone, as building material, will do well to peruse Dr. Draper's articles with attention.

THE STUDY OF SCIENCE IN SCHOOLS.

There is not an inventor or mechanic who does not suffer for want of a good elementary training in mathematics and the sciences; and yet, notwithstanding this notorious fact, it seems impossible to introduce such a reform in our school education as will successfully remedy the evil. The chief difficulty in the way of reform is in the supply of teachers. Our training schools have raised up teachers whose minds run in the same groove, and who have no mental switch by which they can turn off on to a new track. The custom of learning everything by rote, and reciting like a parrot, has become so embedded in our system of education, that it seems almost impossible to find any explosive sufficiently active to blow it up, and no jack screw or hydraulic ram is powerful enough to move our Boards of Education from their firm foundations. But as the continued dropping of water may wear away a stone, we propose to keep adding here a little and there a little, until some impression has been made and some good has been accomplished. It is probable that we must look to the West for our chief support in the war that it is proposed to wage against the relics of monastic education. They have a practical way of viewing things in that section of the country, and common sense is allowed to have due weight in questions of all kinds. We are, therefore, not at all astonished to learn that, at the University of Iowa, instead of teaching physics, chemistry, geology, and astronomy, by oral recitations and unillustrated lectures, they have established laboratories and workshops, where practical things can be practically learned, and theoretical ones can have all of the weight that properly belongs to them. The trustees of the Iowa State University have resolved that the only way in which instruction in science can become thorough is by placing the elements of physical science at the very beginning of the course. They do not propose to wait until the pupil, by droning over dry facts and abstract principles, has acquired a disgust for every branch of knowledge, but they think it wiser to pursue the natural method, and begin when the mind is anxiously inquiring into the cause of things, and the boy takes his watch apart to see what makes it go. The old-fashioned way was to give the boy a sound flogging, to

take the watch away, and make him learn by rote the principles of compensating balance wheels.

"My dear boy," says the teacher, "the duration of an oscillation depends on the radius of the wheel, the mass of its rim, and the strength of the spring," which, of course, is very intelligible to the lad, and would enable him at once to construct a new watch.

Common sense would dictate the propriety of showing up the parts of the watch, and by degrees expounding the principles upon which the construction is based. Theory and practice is what we want, and not either of them alone. Technical instruction alone will not result in the advancement of science, but that, together with a thorough training in the phenomena of Nature, will lead to great progress.

For the purpose of aiding in the introduction of experimental science in our schools, Professor Gustavus Hinrichs, of Iowa, has published "The Elements of Physical Science," and "The School Laboratory of Physical Science," books which are intended to serve as guides to teachers and pupils.

The author says that, under his system, the result is "a marvel of studious industry." The students enjoy measuring, weighing, testing, demonstrating, and recording facts which, in former times, were pored over in a maze of bewilderment in the driest text books, to be afterwards bolted in sections without question. He proposes that the course shall be divided into three parts, rudiments, elements, and general principles—all of which should be completed in the high school course, and be conducted with facilities as good as have so long been afforded in other departments. By securing in this way a sound elementary training, two very important advantages are gained: First, if, as often happens, the boy is unable to pursue his studies beyond the high school, he will not be compelled to grope about in utter darkness in his subsequent career, but will be so far grounded in principle and practice as to be able to avoid the errors which now pervade society, and give aid and comfort to believers in perpetual motions and mysterious agencies. Second, the advantages, to those who have the means of pursuing their studies beyond the confines of the high school, will be very great. Having surmounted the elements of knowledge, they are in condition to prosecute their studies to a higher point than was hitherto possible, and the advantages to themselves and to society would be very great.

In the first part of his book, Professor Hinrichs takes the pupil through a course of simple and easy experiments relating to magnitude, weight, machines, properties of matter, light, electricity, and magnetism. The metrical system is taught by means of actual measurements performed by the scholars themselves, and the pupil constructs his own measures of weight and length, makes numerous determinations, and puts down results in his journal. There are blank pages at the end of the volume for independent observations and experiments.

This strikes us as the only sensible way in which to impart instruction in science, and after it has been practiced for one generation, the condition of society will be found to be vastly improved. The best interests of education demand that we should begin at the bottom of the ladder and not at the top. The top can take care of itself, but if the foundation be weak and rotten, the bottom and the top will topple down to a common ruin.

[Special Correspondence of the Scientific American.]

A NUMBER OF EXTENSIONS.—TEDIOUS SEWING MACHINE CASE.

WASHINGTON, D. C., Nov. 15, 1871.

Among the extensions recently granted is the patent to J. W. White for a cotton seed planter. It consists of a frame with a seed wheel mounted within, a furrow opener attached to the forward part of the frame, and an adjustable seed coverer suspended from the rear. It is said to save fifty per cent in labor, and do much better work than hand labor. The civil war prevented the patentee from securing a suitable reward for his invention.

Also the patent of George S. Butterfield is extended. It is a grinding and polishing machine, designed especially to improve the manufacture of knives for planing machines, in which a perfectly plane and true surface is a great desideratum, the grinding by hand being very defective in this respect, as well as laborious. The result is secured by causing the article to be ground to reciprocate, vertically and horizontally, in a plan tangential to the face of the grinder. The mechanism for giving the vertical movement is very ingenious and elaborate. This particular compound movement, however, was not new, the same having been provided for in a patent issued to William Harvey as early as 1847, and in other patents antecedent to Butterfield's. The invention reduces the cost of the knives at least ten per cent. The machine is a valuable one and substantial profits have already been realized.

Also an extension is granted to E. H. Smith for a sewing machine shuttle. The invention is pronounced by the Examiner to be a very meritorious one, and as yet not suitably rewarded.

Willard & Ross' improvement on harvesters. This patent was reissued in 1864, in seven divisions, and in four of these, extensions have been granted. The patent is an improvement on what is known as the Ball machine or Ohio Mower. In that machine the double hinged coupling arm is used, giving a flexible connection to the finger bar, and rendering it capable of freely conforming to an uneven surface. The improvement consists in projecting the inner end of the finger bar beyond the lower joint, to form a knuckle, and in pivoting to the coupling arm a lever to act in connection with it, by which the lower joint is made rigid; so that, when the heel of the finger bar is raised to pass obstructions,

the outer end can be lifted also. This locking and lifting device constitutes the leading feature of the invention, and in the original patent there were but two claims, though the reissues embrace fourteen claims. The devices are simple but useful.

John Griffin's pile for wrought iron beams and girders. This improved pile closely resembles, on a cross section, a finished beam, and the rolling is therefore effected without any great reduction of its different parts, and consequently without any very unequal tensions of the fiber of the metal. In the case of other piles, the tension during the process of rolling is so unequal as, more or less, to tear the metal and separate the flanges from the web, thereby checking the edges of the flanges. Griffin's pile has thus far been used exclusively by the Phoenix Iron Company, of Phoenixville, Pa., and by Palmer & Co., at Buffalo, N. Y.; and these companies have manufactured more than two thirds of the beams and girders made in this country since the patent was issued, amounting to 37,758 tons. The advantages arising from the invention are, first: that cheaper iron may be used. Second: lighter and cheaper machinery may be used in rolling it. Third: the beams are much superior to those made of the ordinary rectangular pile. Fourth: larger beams can be rolled, the size being limited only by the size of the roll trains and the capacity of the furnace. The royalties to the patentee have already amounted to a large sum, but in consideration of the value of the invention, the Office does not consider that he has been suitably rewarded. To the public, the saving has been from one to one and a half cents per pound, amounting already to the sum of \$700,000. The use of wrought iron beams in public and private buildings has greatly increased of late years, and in 1857 the manufacture was exceedingly limited. Since 1861, the Government has procured from the companies referred to, not less than 4,000 tons of fifteen inch *chassis* rails, for fortification ordnance; and the saving arising from this invention is not less than \$120,000. It is patented in England, France, and Belgium.

William Pratt, for an improvement in safety lamps. This is a protection against the explosion of vessels containing a volatile inflammable liquid; and consists of a volute of ribbed metal wound together, forming a series of regular tubes, inserted in the main orifice. The parts are so arranged that the wick cap cannot be removed until the cap of the feeder tube has been removed. The invention does not appear to have gone into general use, but it is claimed to be one of great utility.

William Sellers' improved machine for threading bolts, the object being to avoid the necessity of reversing the motion of the cutting dies or stopping the machine to change the bolts, and to facilitate the change of the dies. It is claimed that the machine does twice the work of an ordinary machine. If the 402 machines, manufactured and sold, had been in constant use during the fourteen years since the patent was granted, it is calculated, and the estimate is supported by practical machinists, so that the saving to the public would have amounted to the sum of \$1,081,500. The profits to all the parties interested are estimated at about \$50,000.

W. H. Nettleton's machine for turning pillars for clock movements. Nearly all the clock pillars made in the country are manufactured on this machine. In the town of Bristol, Conn., there are nine clock making companies; and one of these manufactured last year 40,000 clocks.

Pierpont Seymour's machine for spreading lime and other fertilizers. The invention is a mechanism for operating a hopper with an inclined bottom provided with reciprocating bars.

Richard M. Hoe's printing apparatus consists in locating the cam shafts for driving the fly frames close up to the frames, greatly reducing the jar and wear of those parts. A simple invention, but one which saves annually, to each press on which it is used, the sum of \$150. Patented in England.

Alexander S. Newton's machine for turning wooden boxes. An arrangement of devices by which round wooden boxes can be made from a square stick, thereby saving the expense of rounding the timber before it is placed in the lathe.

The following applicants have been refused:

Nicholas Whitehill, for a cultivator. The machine is a straddle row cultivator, the middle being elevated to pass over the row of corn, and provided with a compound evener suspended on three points. Remonstrants claimed that the patent was anticipated by the patent to Stahl and Hiffenbacher, as early as 1835, and also by five other patents of later date.

W. N. Clark, for an elastic door guard, being a rubber buffer, confined by an escutcheon ring, to receive the force of the door, knob and protect the wall. In this case, the original application as well as the application for re-issue was refused by the Examiner, but finally allowed on appeal. The Commissioner decides that "applicant has monopolized more than his invention in his re-issue, and is not entitled to further monopoly of even what he did invent."

It is not uncommon in the regular routine of the Patent Office for an application to become somewhat snarled and tangled, and generally off the track. In January, 1869, William Duchemin, of Boston, applied for a patent for an improved sewing machine for manufacturing shoes, and its history in brief is this: February, 1869, letter from office rejecting some claims, showing needed corrections in specifications, and calling for an additional drawing. May, 1869, applicant informed that a certain clause of his claim must be limited if he wishes to avoid an interference with a subsequent application. May 20, 1869, interference declared. June 9, 1869, interference dissolved. New interference declared between applicant and three other applicants. September, 1866, decision in favor of Duchemin. Case appealed to Examiners-in-Chief, who, in January, 1870, decided against

Duchemin. Case appealed to Commissioner, who, in April, 1870, sustains the action of the Board. Then appealed to Supreme Court of the District, and decision in favor of Duchemin, July 7, 1870. On return of case to the Office, in May, 1871, the correspondence was opened, which resulted, in June, 1871, in still another declaration of interference, in this case with a patent, which interference was dissolved in August, but followed in a few days by a fourth interference. The above leading actions were interspersed with sundry correspondence and conferences too numerous to mention; and finally the points at issue were so adjusted that the case was passed on the 6th instant, and appears in the regular issue of the 28th.

SCIENTIFIC INTELLIGENCE.

CHEAP PREPARATION OF CHLORINE.

Tessié du Motay, whose name is identified with the cheap production of oxygen and hydrogen, has invented a new process, for making chlorine, that seems worthy of notice. He first prepares chloride of manganese in the usual way, and decomposes this by heating it, in contact with steam and air, in earthen retorts, whereby chlorine and hydrochloric acid are evolved. If oxygen or air is passed over the red hot chloride of manganese, chlorine is given off and peroxide of manganese reproduced. If over this material a mixture of hydrochloric acid gas and air or oxygen is passed, chlorine is continuously produced and peroxide of manganese regenerated. The method appears to possess advantages over the mixture of common salt, manganese and sulphuric acid, or of manganese and hydrochloric acid, formerly employed, as it is continuous; and, after the first outlay for materials, the chief running expense would be the fuel, as the hydrochloric acid required for decomposition would cost very little.

DEPOSITING ALUMINUM ON METALS.

J. Baynes Thompson, of White Hall, England, writes to the editor of the *Chemical News* that for more than two years he has been depositing aluminum dully on iron, steel, and other metals, and driving it into their surfaces at a heat of about 500° Fahr., in the same way as he does silver and nickel. He also says that he can do the same thing with aluminum bronze, of various tints from the palest lemon to the richest gold color. Some years ago, Dr. Gore, of Birmingham, England, also claimed to be able to coat copper, brass, and German silver with aluminum by means of electrolysis. As there is no reason to doubt the veracity of either of these gentlemen, it would appear to be a fact that aluminum can be deposited by electro-galvanic action the same as nickel, copper, and other metals. We should be glad to be furnished with the details of the process.

KLINKERFUES' PATENT GAS LIGHTER.

On page 393, Vol. XXIV., we gave a full description of Dr. Klinkerfues' ingenious contrivance for simultaneously lighting the street lamps of a large city. We learn from the *German Journal für Gasbeleuchtung* that the inventor proposes some important modifications in the apparatus. Instead of having a separate tube for regulating the pressure, he proposes to use the ordinary pressure of the gas mains. There are three conditions required: In the first, the apparatus must be out of function and the gas tube closed; in the second, the plates of the battery must touch the exciting liquid and the gas tube open ready for ignition; in the third, the plates must be raised out of the liquid, but the tube must be open for the supply of gas to the burner. The first condition can be attained for each lamp by regulating the apparatus according to the pressure of the day time; the second is put at the evening pressure, with the addition of a few tenths of an inch so as to assure the lighting of all the lamps. The excess of pressure can then be removed and the lamps will continue to burn until, by reversing the process, the day pressure is reached and the supply of gas again cut off. The parts of the apparatus remain the same as heretofore described.

RED, GREEN AND BLUE FIRE.

In pyrotechny it often happens that colored fires produce disagreeable fumes or burn too slowly. In order to surmount these difficulties, a German chemist, J. R. Braunschweiger, has been making some experiments, and, as the result of his labors, gives the following recipes:

Red fire, 9 parts nitrate of strontia; 3 parts shellac; 1 1/2 parts chlorate of potash.

Green fire, 9 parts nitrate of baryta; 3 parts shellac; 1 1/2 parts chlorate of potash.

Blue fire, 8 parts ammonium sulphate of copper; 6 parts chlorate of potash; 1 part shellac.

It is only necessary to reduce the shellac to a coarse powder. The nitrate of strontia, baryta, and the ammonia salt ought to be intimately incorporated with the shellac before adding the chlorate of potash; and, as any hard rubbing or percussion of the latter salt in a mortar might occasion an explosion, it is better to mix by transferring from one sheet of paper to another, and not attempt to rub the mixture at all. By the above mixture, the suffocating odor of sulphurous acid is avoided, and the fireworks can be let off without inconvenience in any large room. To obviate the danger of spontaneous combustion, the chlorate of potash could be stored in a separate bottle and mixed when wanted, in the way described.

NITRIC ACID IN WELL WATER.

A. Wagner has determined the amount of nitric acid in a large number of wells in the city of Munich, and finds, for the water obtained directly, an average per liter of 0.1553 grammes nitric acid, equal to 0.2908 grammes saltpeter; and for water introduced by pipes, 0.0249 grammes nitric acid, equal

to 0.0485 grammes saltpeter. As 14 milliard liters of water are annually consumed in Munich, if it were all drawn from the wells it would yield 4,071,200 kilogrammes of saltpeter. The author thinks that enough saltpeter is annually consumed in the drinking water of Munich to make 5,500,000 pounds of gunpowder. What the effect of this enormous consumption of saltpeter may be upon the health of the inhabitants is not stated by the author.

PRESERVATION OF MEAT.

At the meeting of the Lyceum of Natural History on Monday evening, Dr. H. Endemann read a paper on this important subject, in which he gave an account of a process invented by himself. About 100 pounds of meat are placed in a suitable chimney, and air, heated to 140° Fahr., is drawn by an exhaustor through it until it is entirely dry.

Great care is observed, by the introduction of thermometers in different places, that the heat does not get above 140°, as in that case the albumen and fibrin might be coagulated and much more difficulty encountered in expelling all of the water. The air is filtered through cotton before being passed through coils of steam pipe for heating. The meat is subsequently ground into powder, and will keep in ordinary paper packages. It can also be compressed into hard cakes, for diminution of bulk. Four to five ounces of the dry powder represents one pound of meat. Scattered upon bread, its flavor is excellent and preferable to that of raw meat. It has an agreeable aromatic odor; and, as all of the albumen and fibrin are present, all of the nutritious properties of the flesh are retained, which cannot be said of Liebig's extract where these important constituents are wanting. It was stated that the expense of drying need not exceed one cent a pound. Any method by which we can reduce the price of beef must be looked upon with favor; and it is to be hoped that the plan proposed by Dr. Endemann may prove successful.

PRINCE ALEXIS—HIS WELCOME TO AMERICA.

Full accounts of the brilliant reception of Prince Alexis have appeared in the dailies. The reception was admirably arranged, and the unmistakable cordiality and warmth of his greeting must have been highly flattering to the youthful scion of royalty.

The prince is the third son of the Emperor Alexander II, and was born January 14, 1850. He bears the name of Alexis Alexandrovitch, or Alexis the son of Alexander. He is a Grand Duke, and Chief of the Infantry regiment of Ekaterinbourg and of the first division of the Finland fleet. The Prince Alexis has received a good German education, as well as a thorough training in military and naval tactics. He is reported as in favor of liberal principles, and as opposed to the reactionary policy of the Old Russian party, of which his elder brother, the Czarévitch Alexander, is at the head.

All unite in praise of his fine manly bearing. His stature is above the average of what are usually called large men. He is six feet two inches in height, and broad in proportion. His look is commanding, and he seems possessed of a fine, cultivated mind. Followed everywhere by good wishes, we trust his visit to the United States will prove one of the happiest events of his life.

NEW BOOKS AND PUBLICATIONS.

ENGINEER'S POCKET BOOK. A Pocket Book of Useful Formulae and Memoranda for Civil and Mechanical Engineers. By G. L. Molesworth, Member of the Institution of Civil Engineers. Seventeenth Edition. Royal 32mo; roan. Post Free, \$2. E. & F. N. Spon, London, and 446 Broome Street, New York.

This invaluable pocket book for the engineer is just published in this country, and is a new and improved edition, containing 150 pages additional matter—450 in all. This, the *seventeenth* London edition, has been rewritten and thoroughly revised, the past year, by its author, bringing into its pages the results of the latest experiments and advances in engineering science. It is one of the most complete, correct, and reliable collections of Civil and Mechanical Engineering Formulae and Memoranda extant. The sale in England alone has reached 40,000 copies, with an increasing demand; and we recommend it to the attention of our engineers and inventors as a profitable investment.

Examples for the Ladies.

Mrs. Mary O. Lewis, of Tremont, Westchester County, N. Y., reports her personal earnings, by stitching only, with a Wheeler & Wilson Machine, as follows: Earned in 20 months, \$730; average per month, \$36.50; per day \$10.76; earned in one day of 18 hours, \$30; earned in one month, \$350, an average per day of \$11.67; earned in 12 months, \$375, averaging per day \$12.50. She has used the sewing machine 17 years, and is now, and was during that time, in robust health.

Dandruff can be removed by the use of Burnett's Coseoline; also Irritation of the scalp.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Workingman's National Illustrated Paper—the "People's Monthly" of Pittsburgh. Pure, live, cheery and wholesome. Teems with cuts and practical information. Try it for the new year. Only \$1.50.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$1.00 a year. Advertisements 10c a line. An Incubator wanted. G. L. Wing, Somerset Mills, Me.

For Sale—A First Class Engine, 40 Horse Power, two years in use. To be seen working at 102 Attorney Street, New York.

A Traveler of experience and reputation could sell specialties in Crockery, Cutlery, Silver and Glass Ware, Lamps, Gas Fixtures, House Furnishing, &c., on commission, from Jan. 1st, to the Jobbing trade only. Address Lock Box 125, Pittsburgh, Pa.

Wanted—Straw Paper Machinery. N. P. Mix, Columbus, O. Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufacturing, 600 E. 9th Street, New York, and 120 N. 3d Street, St. Louis, Mo.

Hand Saw Manufacturing at the West is comparatively a new industry. Western dealers and consumers are referred to the advertisement of Woodruff & McParlin, on another page.

The best Engine Lathe and Planer Makers, please send circulars and price list to G. F. Capewell, Cheshire, Conn.

N. H. Taylor, Engraver on Wood, re-established at 30 W. Madison Street, Chicago.

Patent Iron Rim Moulders Riddles and Sieves. Send for Circular. Horton & Mable, Peekskill, N. Y.

3 Hydraulic Presses for sale on reasonable terms. Apply to Whitneyville Armory, Conn.

Wanted a set of second hand Stamps, complete, such as used for stamping ores. Address Box 460, New York Post Office.

Cutting and Stamping Presses, Lathes, Small Engines, other Machinery, small lathe Castings. Address J. M. Danc, Jr., 35 Liberty St. N. Y.

Metallic Molding Letters, for Pattern Makers to put on patterns of Castings, all sizes, etc. H. W. Knight, Seneca Falls, N. Y.

The Pew Hat Rack, State and County Rights. E. S. Blake, Pittsburgh, Pa.

The best wood filler in use, 25 cents per lb. Made, used, and sent (in packages of not less than 16 lbs.) all over the country, C. O. D., by L. W. Jones, Unionville, Conn.

The best and cheapest Self Oilers are manufactured by Holland & Cody, 8 Gold Street, New York. Send for price list.

Land sufficient for the purposes of any good manufacturing business, and most admirably located on the Poughkeepsie & Eastern R. R., with plenty of water for steam purposes at hand, and only fifteen minutes' walk from the center of the city, will be given to any parties who meet the views of the owner. Address P. O. Box 524, Poughkeepsie, N. Y.

Tested Machinery Oils—Kelley's Patent Sperm Oil, \$1 gallon; Engine Oil, 75 cts.; Filtered Rock Lubricating Oil, 75 cts. Send for certificates. 118 Malden Lane, N. Y.

Use Soluble Glass for fireproofing Wooden Pavements, Shanties, R. R. Bridges—also as common hardening Mortar and Cements, makes most durable Stove and Foundry Putty, Iron Cement. Apply to L. & J. W. Feuchtwanger, Chemists, 55 Cedar Street, New York.

One "Scott's Wheel Moulding Machine," saves \$5,000 yearly in patterns—wheels absolutely perfect. Engraving sent free. Hamilton E. Towle, 176 Broadway, New York.

Portable Farm Engines, new and beautiful design, mounted on Springs. Compact, light, and efficient. Send for descriptive circular. Mansfield Machine Works, Mansfield, Ohio.

For the best 15 inch Eng. Lathes, Bench Lathes, or Friction Pulleys, address John E. Abbe, P. O. Box 335, Providence, R. I.

Kelley's Chemical Metallic Paints, \$1, \$1.50, \$2 per gallon mixed ready for use. Send for cards of colors, &c., 118 Malden Lane, N. Y. Stencil Tools & Steel Letters. J. C. Hilton, 66 W. Lake St. Chicago.

To Boiler Makers—Water Gauges sold cheaper by us than any other House in the Country. Holland & Cody, No. 8 Gold St., N. Y.

Baxter's Adjustable Wrenches fit peculiar corners where no other will work. All first class mechanics need one. Baxter Wrench Co., 13 Park Place, New York.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Shoe Peg Machinery. Address A. Gauntt, Chagrin Fall, Ohio.

We will remove and prevent Scale in any Steam Boiler, or make no charge. Geo. W. Lord, 155 Girard Ave., Philadelphia, Pa.

Builder's Scaffold—Patent for Sale—For further particulars, address Redick & Kunkle, Butler, O.

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

Walrus Leather, for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

Kelley's Pat. Petroleum Linseed Oil, 50c. gal., 118 Malden Lane.

Turkey Boxwood pieces for Sale, suitable for engravers and fancy turners' use. Address Stephens & Co., Hiverton, Conn.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

The best lubricating oil in the world is Winter pressed Sperm. Sold in bottles, cans, and barrels, by Wm. F. Nye, New Bedford, Mass.

Best Oak Tanned Leather and Vulcanized Rubber Belting. Greene, Tweed & Co., 18 Park Place, New York.

To Cotton Presses, Storage Men, and Freighters.—33-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 35 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water St., New York.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 414 Water St., N. Y.

Presses, Dies, and Tinner's Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water St., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Rice & Co. See advertisement.

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

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

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. B. Baldwin, Lacrosse, N. H.

Blake's Belt Studs. The cheapest and best fastening for Rubber and Leather Belting. Greene, Tweed & Co., 18 Park Place, N. Y.

For Best Galvanized Iron Cornice Machines in the United States, for both straight and circular work, address Calvin Carr & Co., 35 Merwin St., Cleveland, Ohio.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and set by J. Dickinson, 41 Nassau St., New York.

Power Punching and Shearing Machines. For car builders, smith shops, rail mills, boiler makers, etc. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

Francis Schleicher, Consulting, Analytical and Man'g Chemist. Laboratory, Newark St., bet. Jackson and Harrison St., Box 125, Hoboken.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms \$4.00 a year.

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 100 a line, under the head of "Business and Personal."

ALL references to book numbers must be by volume and page.

S. F. M., of Ill.—You can make a magic lantern with two fine sets of photographic portrait lenses, that will give good sized images.

R. L. K., of ——You should be able to get such a spring as you require made in any good machine shop.

W. H. B., of Va.—Your suggestion in regard to tramways is not new.

J. E. B., of O.—The metallic specimen you sent is pure galena, a valuable ore of lead. The other two are barytes, extensively used for white paint.

PURIFYING KEROSENE OIL.—N. L. & Co. can recover kerosene, after using it to remove whale oil and grease, by distillation at a low temperature—say 130° to 150° Fahr. Probably the contaminated kerosene, if in considerable quantity, can be sold to the refiners.—H. G. F., of Va.

CONDENSATION ON WINDOWS.—Let J. E. G. double the glass in his show window, leaving a space of one fourth of an inch between each pair of lights. If he wishes to test the above, he can try it on one light or section of his window.—C. H. B.

DISCOLORATION OF BRICKS BY SMOKE.—Whitewash with sifted wood ashes; a double handful of the pallid will do the thing nicely. The ashes form a lye that acts upon the soot. A coloring matter can be added if desirable, or the wall might be gone over by a man whose trade is called tucking.—C. H. B.

WEAR OF SLIDE VALVES.—If a valve's diameter is five inches and it moves two inches, there is a space of three inches in the center, say over the ports, always covered, and of course always under wear; while there is one inch, at either end of the stroke, that is under wear just half the time. If W. C. would overcome this, he must adopt a cylindrical oscillating valve, which, properly constructed, wears tight.—R. H. A., of —

PUMPING WATER A LONG DISTANCE.—I would inform M. H. P., through your columns, that he can pump water the distance and rise he speaks of, and even further. I can show him a pump that draws the water 280 feet horizontally and 27 feet perpendicularly. It has been in use four or five years, pumping water for a farm yard, and has had no repairs until this season.—E. A. P., of Vt.

CEMENT FOR AMBER.—J. R. (query 13, November 18) can cement or mend amber by smearing the surface of the pieces with linseed or boiled oil, and then strongly pressing them together, at the same time holding them over a charcoal fire or heating them in any other way in which they will not be exposed to injury.—C. E. B., of N. Y.

CANKER IN MOUTH.—I would say, in reply to F. S. C., let him take one ounce of mullated tincture of iron, and add four ounces of water, and rinse his mouth frequently with it. He will have no more canker.—G. H. J., of N. H.

CANKER IN MOUTH.—In answer to query No. 7, November 18, I would say to F. S. C. that local application will afford but temporary relief in cases of obstinate sore mouth. If his trouble has been caused by the excessive use of bad chewing tobacco, or by the adhesion of tartar on his teeth, let him remove the cause, and then gargle with a strong solution of white copperas (sulphate of zinc), using great care not to swallow any of the gargle, as it is a violent poison when taken into the stomach.—A. B.

CANKER IN MOUTH.—If F. C. S. will follow this advice (and I suppose he will not) he will doubtless get rid of the canker, if he means, by that, sore spots about the tongue and mouth. These ulcers, simply symptoms of irritation of the stomach, cannot be cured but by removing the cause. Keep yourself a little hungry, eat no swine's flesh, keep your bowels persistently free by opening diet, do not drink whisky, and you will soon rejoice in a sound mucous membrane.—R. H. A., of —

AMALGAMATING ZINCS FOR BATTERY.—Lay the zincs upon some flat surface or an earthenware plate, and wet them with diluted sulphuric acid, say acid one part to water twelve parts. Then pour on some mercury and rub it on with the finger. If the mercury rolls up in little round balls, add a few more drops of the acid solution. If S. H. intends to use the solution of sulphuric acid for his exciting fluid, the above will be the proportions of water to acid.—J. F. of Ga.

WORKS ON METALLURGY.—S. H. will find the "Manual of Electrometallurgy," by Napier, and "Elements of Electrometallurgy," by Smee, probably the best works on the above subject. The first named volume contains all he will require to know.—J. F., of Ga.

COLORING GOLD.—To obtain the red color of fourteen carat gold in plating, prepare a solution of cyanide of gold and cyanide of copper, add the cyanide of copper to the gold solution, until the desired color is obtained. Mode of application: use gold of the desired color. The cyanide of copper is prepared by adding cyanide of potassium to a solution of sulphate of copper until the precipitate at first thrown down is redissolved.—J. S. G. S.

MATERIALS FOR FILTER.—R. B. M. wishes to know the best form of filter. I know of nothing better than soft bricks. They will necessarily be put in the form of a partition, laid in cement, so that the water cannot get between them, and allowing the water to pass through the thin way of the brick. This may color the water a little the first time the filter is filled, but after being pumped out, it will be perfectly clear the next time, if the shingles do not color it.—S., of Mass.

BLACK COLOR ON BRASS WORK.—I take pleasure in complying with C. D.'s request. Make a strong solution of nitrate of silver in one dish and of nitrate of copper in another. Mix the two together, and plunge in the brass. Now heat the brass evenly till the required degree of dead blackness is obtained. This is the method of producing the beautiful dead black, so much admired in optical instruments, and which was so long kept a secret by the French.—L. B.

CASE HARDENING.—In answer to E. N. G., I would say that I have used two kinds of case hardening to good advantage. These two kinds I will term the quick and slow processes. The first is done by heating the article you wish to harden to a red heat, and rolling it in or sprinkling it with prussiate of potash; then reheat it to the fire and heat to a light red, then plunge it in water. The next or slow method is done by burning scraps of leather to coal and pounding fine; then putting the ash in a sheet iron box in layers with the article which is to be hardened. Begin and end with the coal; place the box and contents in a sharp fire for an hour or an hour and a half; then dump the contents of the box into water. This hardening is used by many gunsmiths to produce the colors often seen on iron gun mountings. It may be polished, if desired.—J. H. H., of Mich.

AMALGAMATION OF ZINC PLATES.—Let S. H. immerse his zinc in sulphuric acid diluted by water to about two thirds its former strength, and let it remain until the dirt is removed, and then immerse in mercury. If the amalgamation is not perfect or nearly so, repeat the process; but if it is not perfect, it will make no perceptible difference in the use of the battery.—G. A. F.

BLACK FINISH ON BRASS INSTRUMENTS.—In answer to query in SCIENTIFIC AMERICAN of November 18th for process of blacking brass work, as done on optical instruments, let C. D. procure a spirit lamp or gas jet with large flame and a brass plate, also some nitric acid (not too strong, but strong enough to fume briskly) in which let him dissolve silver and copper in the proportion of a piece of each about the size of a grain of wheat to a quart of acid. If he has much work to blacken, he should have enough acid to dip his work into, after which it should be allowed to drain a minute. It will then be of a rough green color. Then, having the brass plate heating over the lamp, let him lay the article on it; if the plate be hot enough, his work will turn of a dingy, rough, scaly looking black in about fifteen minutes. Then let him take it off and let it get cold. Lastly, rub the surface and polish with a little olive or other oil and a piece of soft leather. If only a few articles are to be blacked, use less acid, and rub it on with a cloth tied on the end of a stick.—D. L. B., of Pa.

HEATING SMALL STEEL ARTICLES.—Let P. L. S. place a black lead or common cast iron crucible (capable of containing two or four quarts) filled with lead, on a fire made of charcoal. The crucible should rest upon bars of iron just above the blast. Place a wall of brick around the crucible, leaving sufficient space between the wall and crucible (say six or eight inches) to fill to the top of the crucible with charcoal. By leaving draft holes in the brick wall at the bottom below the grate (made of the iron bars) on two or three sides, there will be sufficient draft to keep the lead hot. Place the shaft of the knife blade in the tongs, at right angles with the jaws, and let the tongs rest on the top of the crucible, while the knife blade is submerged in the heated lead. Have two pairs of tongs, and put in a cold blade before taking out the hot one to work. Grease the blade with some cheap grease which will prevent the lead adhering to the article. By having two or three pairs of tongs, the articles will heat as fast as they can be hardened. I have used the process for years when in the cutlery business in New England.—S. A. W., of Iowa.

PUMPING WATER FROM LONG DISTANCES.—M. W. Q., of Mo., is mistaken in saying that "ten feet horizontal is equal to one foot perpendicular." The distance horizontally from which water is brought to a suction pump is of small consequence, if only the pipe be large enough to reduce the friction to a minimum; because friction is the only obstacle to the conveyance of water to any distance horizontally, if only the air be exhausted from one end of the pipe. All suction pumps that draw the water for a considerable distance horizontally or vertically should have a vacuum vessel. At every stroke of the piston, the entire column of water, of whatever height or length, is put into rapid motion, and if there be no vacuum vessel, the motion of the column is suddenly checked at the end of the stroke, and a great effort is required at the commencement of it to set the column into motion again. A vacuum vessel, which should be of ample capacity, will prevent all shock by the column at the end of the stroke, and all jerk at the beginning of it. I have now four pumps with vacuum vessels, driven by steam, all of them drawing fluids horizontally with great ease, without jerk or shock. The vacuum vessels, in my case, are simply pieces of gas pipe, two inches in diameter and four feet long, joined with the suction pipe just under the pump by an inch and a quarter connection. One pump, with leaden pipe, has a piece of leaden one and a half inch pipe, five feet long, soldered to the suction in the same position. The action is perfect. The longer the distance horizontally, the larger the suction pipe must be to avoid friction.—N. D., of Me.

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.—**RESISTANCE OF BRASS TO PRESSURE.**—How much internal steam pressure per square inch will a cylinder, nine inches in diameter, thirteen inches long, made of twenty-four gage sheet brass, stand?—J. S.

2.—**POCKET ELECTRIC BATTERY.**—Will some electrician inform me if I can make a battery small enough to be carried in a coat pocket, and powerful enough to give an electric light? A mere spark is all that is wanted. What is the best form of battery?—J. S.

3.—**TANNATE OF SODA.**—In the SCIENTIFIC AMERICAN of October 28th, there is an article on boiler incrustation. Dr. J. G. Rogers recommends, as a preventive, tannate of soda; will he, or some one else, inform me what quantity to use, say for a 40 horse boiler using 100 barrels water per day?—E. F.

4.—**GRAPE JUICE.**—Having a quantity of grape juice, in casks, which is now fermenting, I would like to know how to make it into good wine.—M. T. M.

5.—**FITTING MOLDING.**—Can any of the readers of the SCIENTIFIC AMERICAN give me a rule for fitting rake and crown molding, or cornice, that will work to better advantage than sawing it up, which is seldom an easy job, when the jet is wide and the staging is narrow, as is often the case at the corners when jacks are used for a staging?—S.

6.—**BEES IN WINTER.**—Will bees smother in their hives if they happen to get covered up with snow all winter? My bees are near a fence, on the summer stand, twenty inches from the ground, and the hive ventilated from bottom only. How much honey will a stock consume in a winter?—J. E. R.

7.—**SOFTENING OIL STONES.**—Is there any process that will have a tendency to soften an oil stone? I am a mechanic and have a great deal of trouble in getting a good oil stone, they all being too hard.—C. H.

8.—**GLUE FOR JEWELLERS.**—I would like to know the best glue to use at a watch maker's and jeweller's bench, for general purposes in that line of business. Also the best method of tempering lifting springs for watch cases.—R. K.

9.—**CEMENT FOR MENDING CHINA, GLASS, ETC.**—Can any of your correspondents give me a recipe for making a cement for mending china, glass, etc., which will set quickly, and stand hot and cold water? I have tried every thing for sale and have made quantities of cement from book receipts, but the result is the same. Can a cement be made with soluble glass?—G. H. J.

10.—**PRESERVATION OF BELTING.**—Where can I get the best information in regard to the use, treatment, and care of belting, especially leather belting? I am troubled with the rapid wearing out of belts running at high velocity.—W. L.

11.—**ENAMELING CAST IRON.**—Will some one please give us, through your paper, a practical receipt for enameling cast iron, with such enamel as is put on kettles?—W., BROTHERS.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

DISCOVERY IN HOROLOGY.—J. M.

FIREPROOF BUILDINGS.—J. R. M.

INCOMBUSTIBLE LUMBER.—E. C.

PERPETUAL MOTION.—A. J. R.

PSYCHIC FORCE.—A. M. L.—J. M. D.

STANDARD TIME.—F. A. S.

WAVE POWER.—U. S.

ANSWERS TO CORRESPONDENTS.—C. H. K.—G. H. S.—J. G. H.

J. R. J.—J. S. G. S.—M. D. C.—T. L. V. D.—W. J. W.

QUERIES.—C. & H.—C. S. & J. M.—G. W.—I.—S. B. A.

Recent American and Foreign Patents.

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

HAY TEDDER.—John K. Collins, of Hartford, Vt.—This invention relates to a new manner of hanging the forks of a hay tedder, and is an improvement upon a patent granted to the same inventor, October 12, 1865. The axle or cross beam of the hay tedder is supported by wheels and made part of a frame, in which are the bearings of a crank shaft, operating the forks. Rotary motion is transmitted from one or both of the wheels to the crank shaft by a gearing chain or other means. The cranks of the shaft pass through journals affixed to the lower parts of rods, the upper ends of which are slotted and connected with a pin, in the forked ends of levers, hinged to the axle or other part of the frame. From the front ends of the levers are suspended, by a pin, the shafts of the fork. The lower part of each shaft passes through a tubular guide. The crank in revolving causes the rod to vibrate on the pin, and to impart, by means of the connection, the same motion to the fork. The fork is made self-adjusting to the formation of, and made to drop in actual contact with, the ground, to be most effective in operation. To the lower end of each shaft is secured a ferrule, which carries at its lower end a transverse tube. Through this tube is fitted a short rod, around the ends of which wires, constituting the tines of the fork, are wound. The upper ends of these wires are secured in small tubular sockets that project from the sides of the ferrule.

WALKING PLANTER.—Nathan Earlywine, of Centerville, Iowa, assignor to himself and Charles A. Davis, of St. Louis, Mo.—This is a machine for seeding, distribution of fertilizers, etc., for corn, cotton, and other crops. The seed or fertilizer may be dropped in a continuous, drill, or intermittently as desired for crops grown on hills like corn. The machine is light and graceful in design, and seems a good and efficient one.

SPARK ARRESTER FOR STEAM BOILER.—John Gates, Portland, Oregon.—This invention consists in an improved spark arrester for steam boilers, in which the inventor takes advantage of the angle or turn which the air and smoke makes from the horizontal tubes to the perpendicular smoke stack. The greater velocity of the coils, owing to their greater weight, carries them past the lower entrance of the smoke stack to where there is an eddy, or at least insufficient draft to lift them, so that they will fall to the bottom of the smoke box. At this bottom there is a water well. On boats the same may be produced by cutting an opening or slot through the bottom of the boat, so that the coal, etc., will fall directly into the water that carries the boat. The water well may also be provided with two sets of inclined apertures or pipes, through one of which the water enters, while it escapes through the other during the movement of the boat. A constant current of water passes thus through the well, carrying off the coal and sparks. The well may, if desired, be of other construction, so as not to be connected with the bottom of the boat. It may, for stationary boilers or on locomotives, be only a plain water vessel. A wire or perforated screen is set in the smoke box at some distance from the tubes, so that the sparks are thrown under the screen, and are thereby kept from ascending the smoke stack. By this invention, it is claimed, the coals are arrested without making the smoke stack heavy; as the screen is set in the smoke box, with the exhaust above, less volume of vapor is carried through the screen than would be if it were on top, and it is also, therefore, less liable to foul. The coals, when once dropped, never rise again as in other spark arresters, where they dance against the screen until broken fine enough to pass through. The well furnishes good opportunities for getting rid of the blow off pipes and deadening the noise usually made by them.

PERMUTATION LOCK.—Samuel C. Weddington, Jonesborough, Ind.—Each tumbler is provided with a circle of holes with changeable pins, and a groove around its periphery. Each groove has a wire attached at one end to the case of the lock, and by the other end to an adjustable nut block on a screw. These tumblers are kept in their proper positions by the tension of wires, and the tension is increased or diminished by adjusting the nut on the screw. Changes in the combination are made by changing the positions of one or more of the pins in the holes of the tumblers. By an arm on the spindle of the knob, the tumblers are turned and the bolt operated. A recess in the bed tumbler receives the arm and gives it a hold on the tumbler. This tumbler is of irregular form, one end reaching to near the edge of the case, to which is attached a rod, the other end of which is attached to a bolt. The bolt is actuated by means of this rod, as the tumbler is turned by means of the arm on the spindle. Each of the tumblers above the bed tumbler is provided with a slot, which admits the stem of a bolt when the tumblers are properly arranged. The shifting tumbler has a recess in its under side, which receives the spindle arm as the knob is pressed in, by which means the shifting tumbler and the other tumblers are turned and adjusted to the proper position for receiving the stem of the bolt. The edge of the shifting tumbler is cut into a succession of arcs of circles corresponding in number with the holes in the tumblers, and is kept in position, and the changes are indicated, by means of a palley which revolves in the end of a spring lever. In moving or adjusting the tumblers, the arm on the spindle will be in the recess in the shifting tumbler, and the tumblers are put in position by turning the knob, the shifting tumbler serving as a dial, a single mark only for a starting point being necessary. As the shifting tumbler is turned, a click will be heard as the palley on the spring lever passes from off one arc to another, or the friction will indicate its passage, an account of which is kept. The combination being known, the number of arcs indicates the position of the tumbler, and brings the slots in all the tumblers to one position. When this is done the knob is slightly drawn back, so that the arm on the spindle engages with the recess in the bed tumbler; then, by turning the knob, the bolt is drawn back and the door is unlocked.

SAW SET.—This is an improvement upon an invention patented by the same inventor, Erastus Y. Clark, of New York city, April 19, 1870, and which is calculated to supply certain defects and perfect the original device. The present invention consists in applying to the saw set a supporting slide for sustaining the saw as it moves across the apron and anvil during the process of setting, by which the narrowest saw may be securely held and guided over the anvil to bring the teeth properly under the action of the punch.

SEED PLANTER.—Judging from the activity in this class of improvements, the demand for them must be very large, and almost any invention of the kind that can hold its own with those already in market, or better still, make decided advances on the devices already introduced, is, it would seem, sure of sale. The invention under notice is, like most others of its kind, a combination of movements designed to perform all that others have done, and to supply their deficiencies. The combination is essentially simple, and is, we judge, well calculated to secure approval from agriculturists, providing all necessary adjustments to adapt to different kinds of work. Patented by Ezra E. Chesney, of Bushnell, Ill.

COMBINED SEEDER AND CULTIVATOR.—This invention consists in an improved frame on wheels adapted to receive either a cultivating, planting, or a seed dropping device. The invention provides for side variation to prevent tearing up rows in cultivating corn, furnishes a convenient seat for the driver, and places the operation entirely within his control, provides for turning at the ends of rows or the passage of stones, stumps, etc.; for regulating the depth of drills, and supplies adjustments for adapting the machine to sowing in drills or broadcast, regulates the proportion of seed to the area to be sown, and in short furnishes all the appliances necessary to perform the operations named with facility and uniformity. The patentee is Jacob W. Webb, of New Athens, Ohio.

BEES HIVE.—This new form of hive provides for perfect ventilation in summer, and protection of the bees from cold in winter, for the convenient abstraction of honey, and the prevention of injury to the bees from moths. It also provides improved support for the combs, and general facilities for the scientific management of bees. The details cannot well be verbally described. The invention has been patented by William R. Clark, of Piqua, Ohio.

PAPER FOLDING MACHINE.—This is an important invention. The folding apparatus is designed to be attached to printing presses to receive the sheets as they are deposited by the fly. It is impossible to describe in brief the ingenious mechanism which accomplishes the desired results and delivers the papers folded from the press; but it is simple and compact, and is, we judge, an important advance in this class of machinery. Mr. Richard B. Gibbins, of Troy, N. Y., assignor to himself, Patrick J. Fitzgerald and Lewis H. Desouches, of the same place, is the inventor.

APPARATUS FOR CONVERTING MOTION.—Joseph Julien Chenal, of Gènesiat, (Ain), France.—This is an improvement on that for which a patent was issued to Edward Wadham, dated July 11, 1865. In his invention, a rocking or oscillating lever is widened out, at the point where resistance is applied, into a sectoral slot or frame that is armed with teeth so as to engage with mutilated pinions keyed on a shaft passing through said slot or frame. The frame is, however, so constructed, and the pinions so connected with sleeves that turn backward on the shaft, as to cause considerable friction. This the present inventor claims to have obviated by a peculiar construction or arrangement of racks and pinions or toothed disks, as hereinafter set forth. The number of teeth in each disk or pinion is such that, as soon as one ceases to be in gear with its rack, the other will at once mesh with its rack without interruption or dead point. A fly wheel may be fitted on the shaft so as to regulate the motion, which may then be communicated to machinery by any of the known means. Thus the shaft receives a continuous rotary motion, and the action of the two racks gearing alternately, as the lever oscillates, into the partly toothed sectors, (or sectoral pinions,) may be compared to the working of a pinion toothed all round, into which two sectors gear alternately, each on its own side, and moving in opposite directions. Instead of a simple arm, the motive lever may have another arm attached to the other side of the slotted rack frame, thus affording the means of applying additional power, and this second arm will act as a lever of the second kind. Also, in case two arms are used, each of them may have its own slotted double concentric rack frame, communicating motion to two separate shafts; or, the motion of these two shafts may be jointly imparted to one single main shaft—in this case each of the arms of the levers acts both as a lever of the first and second kind. Conversely, by deriving motion from the shaft the continuous rotary motion of the said shaft will communicate an alternate or rocking motion to the lever.

CAT BALLS.—Thomas H. Joyce, of New York city, assignor to himself and Jacob Cohen, of same place.—This invention has for its object to furnish an improved toy for boys, to be used in playing in a manner similar to the game known as "old cat;" and it consists in the toy constructed as hereinafter more fully described. A piece of wood is made in the form of a rectangular pyramid, with the lower part of one side cut off, the face thus formed being the base or bottom of the toy when arranged for play. In the side of the block opposite, from the bottom or cut off part is formed a circular recess, to receive the ball. The ball may be made of wood, rubber, or other suitable material, cork being preferred, as being elastic, and, at the same time light, so that, should it strike a person or thing, it will cause no injury. In playing with this toy the block is arranged with the ball in the recess. The upwardly projecting, or pointed end of the block is then struck a sharp downward blow with a bat or stick, which projects the ball into the air, and the ball must be hit with the bat or stick before it falls to the ground.

SHOVEL HANDLE.—Frank Alsip, of North McGregor, Iowa.—A hand piece is fitted on and secured by bolts or rivets to the lower part of the handle, at or near the upper ends of the straps of the blade. The hand piece projects forward, and its lower end is supported by a brace, the outer end of which is securely attached to the lower end of the said hand piece, and its lower end is attached to the handle at or near the upper end of the blade or plate. By this construction the forward hand of the person using the tool is very greatly relieved of the weight thrown upon it, by bearing down upon the upper end of the handle with the other hand to balance or raise the weight upon the shovel. This invention also relieves the person using the tool from the necessity of stooping so low to lift it as he must with the ordinary construction.

METALLIC CARTRIDGE.—Charles Felix de Dartin and Jules Edouard de Dartin, of Strasbourg, France.—This is an improvement in the class of cartridges so constructed that when the charge is exploded it closes the crevices that exist between the revolving cylinder and the barrel of arms of the revolver class, and at the breech ends of other arms, so as to prevent the escape of gas rearward, and the consequent loss of projective force; and also to produce a cartridge adapted to cause the commencement of the rotation of the ball or bullet before leaving it. To this end the invention consists in providing the front end of the cartridge case with a metallic cap having an aperture for the passage of the bullets, and in forming spiral ribs or grooves on the inside of the said ferrule or lining.

CHAIN LOCK.—Levi F. Cahn, of New York city.—This invention relates to an improvement in the little ornamental padlocks which are applied to watch chains for securing the ends of the same to the garments. The object of the present invention is so to construct and arrange said lock that it cannot be easily opened and removed by thieves, but quite conveniently by its owner. The invention consists in applying the knob above the pivot of the bolt. This will necessitate the pulling of the knob for opening the lock, while heretofore it was made to be pushed. It will be seen that it is much more difficult for a thief to unlock this fastener than those which are opened by gentle pressure against a knob or pin; while for the owner it is equally convenient.

WATCHMAKERS' TOOL.—Leonard C. Butch, of Lancaster, and Augustin F. Thoma, of Piqua, Ohio.—This invention relates to a new and improved tool adapted for several uses in the watch makers' or repairers' trade, such as holding the balance wheel staff for removing the roller table, replacing the said roller on the staff, "poising" the balance, and holding screws, the said tool being constructed and arranged in a peculiar manner to secure the desired end. The tool as constructed is complete in itself—that is to say, is self-supporting, and does not require to be fastened in a vise, as other tools for a similar purpose have to be.

STREET CROSSING.—John Schley, of Savannah, Georgia.—An endless carrier chain is arranged on suitable pulleys, in connection with an arch. The chain is attached to a car, having a rectangular frame over the top. Four spur wheels, preferably of exactly the same diameter, are attached to the car. On the outside of the frame is journaled one front and one rear wheel, near corners diagonally opposite. On the inside and to the car proper are correspondingly journaled the other front and rear wheel. These wheels are cogs so as to work in suitable racks on rails. In order to obtain greater bearing surface and produce perfect steadiness in the car while moving, the inventor uses, in connection with each cog wheel, a smooth traction wheel, attached fixedly thereto, and intended to run upon an ordinary smooth rail beside the cogged rail. The tracks are of the same length, but each as much shorter at one end than the other as is the distance between the axes of the front and rear wheels. The outside track, on which the front wheel has entered, is as much lower than the one on which the rear wheel runs as is necessary to preserve the axes of the front and rear wheels in a horizontal plane. This continues to the top level of the arch, when the outside track rises to the same plane with the other. Upon the opposite side of the arch the outside track continues upon the top of the arch, while the front wheel track is as much depressed upon the decline as was the rear wheel track upon the incline. The vehicle moves continuously back and forth over the arch, always in a horizontal position, and without being turned around.

COFFEE POT STAND.—Oliver Ferris, of Pawling, N. Y.—The object of this invention is to furnish convenient means for pouring coffee, tea, and other liquids from coffee or tea-pots, or similar vessels, without handling such vessels; and it consists of an adjustable stand or platform, arranged to swing on pivots to an inclined position. The vessel is supported and prevented from slipping off the plate by curved stays attached to the tops of arms so that they move with the plate. The latter is operated by a lever or handle. By this arrangement the coffee pot is elevated sufficiently to discharge all the liquid by simply inclining the plate, as described. This is a great relief to the female presiding at the table. The coffee is less likely to be agitated or rolled, as the movement of the pot is more gentle than when it is handled in the usual manner.

OIL CAN.—Donald D. Mackay, of Whitestone, N. Y. and Cyrus Butler, of New York city.—This is a can for holding and applying oils containing plumbago and other heavy matters not combining with the oil, but which settle down upon the bottom of the can and require to be stirred up and mixed with the oil before pouring it out; and it consists in the application, to the interior of an ordinary spring bottom or other can, of a rotary agitating device, and a crank upon the outside for turning it, the spindle of the crank passing through the shell and gearing with the spindle of the agitator.

SEATS FOR CHAIRS AND STOOLS.—This invention relates to a new construction of upholstered chair and stool seats, and has for its object to simplify the same in such manner that can be cheaply produced, and still retain any desired shape that can be formed of wood or metal, and possessing all the elasticity acquired in an ordinary cushion. It consists chiefly in making the solid part of the seat from a perforated recessed piece of wood or metal, which admits the application of the stuffing from beneath. The stuffing, of hair or other material, is introduced between the bottom and cover, after the latter has been fastened to the bottom through a hole in the center of the bottom. By this mode of stuffing a perfect shape can be produced, and, it is claimed, best workmanship obtained at little expense. Such upholstering was heretofore performed by placing the stuffing upon the plain upper surface of the seat, dispersing it thereon as well as possible, and then stretching the cover over the whole. In this manner a good surface and finish could only be obtained with great difficulty, and with the aid of experts, while the present process can, it is stated, be satisfactorily carried out by ordinary hands.—Fletcher W. Dickerman, of New York city, is the inventor.

PERMUTATION LOCK.—John F. Vinton and George A. Hines, of Brattleborough, Vt., assignors of one third their right to Seymour Field, of same place.—This invention mainly consists in an improved arrangement of mechanism with the bolt, locking dog and its lever, the driving wheel and its inner ring, and a tubular bearing connected with the spindle; the object being to produce a lock simple in construction, not liable to get out of order, and hence reliable in operation, and capable of resisting improper attempts to manipulate it. The nature of the mechanism precludes further description, but inspection of the specifications and drawings gives evidence that the lock is a good one.

PRINTING PRESS.—Berthold Huber, of Williamsburgh, New York.—This is an improved movement for printing presses, which shall be so constructed and arranged as to cause the cylinder and bedplate to move at the same rate of speed while in contact, but will cause the bedplate to move at a greater rate of speed while the cylinder and bedplate are not in contact, thus enabling the cylinder to be made smaller than is possible when the cylinder and bedplate move always at the same velocity. The invention consists in the construction and combination of various parts, including a variable crank, in combination with the guide groove and the cylinder of a printing press for driving the bedplate with a variable motion, and a combination of the levers or equivalent with the bedplate, variable crank, guide groove, and cylinder for connecting the variable crank with the bedplate.

ELEVATOR.—David F. Skinner and Joseph Arnold, of Albany, N. Y.—This invention relates to improvements in elevators; and it consists in a novel arrangement of means whereby a weighted lever of a friction brake, employed to regulate the descent of the platform, may be used to actuate the belt shifter and throw the belt on the fast pulley for raising the platform simultaneously with the releasing of the friction or not, as preferred. Also to throw off the belt or stop the platform simultaneously with the application of the friction brake to hold the platform at any point, the arrangement being such that the friction brake may be released sufficiently to let the platform down without throwing the belt on the fast pulley.

FRUIT BASKET.—Henry Carpenter, of Williamsburgh, New York.—This is an improved fruit basket for sending fruit to market, and for use upon stands, to enable the purchaser to carry away his fruit conveniently and safely, and which may be used for various other purposes. It is formed of three strips, strengthened at the upper edge by a band and in the middle part by a strip or handle extended around the sides and bottom, with additional bands if desired.

WASHING MACHINES.—John Fox, of Farmersville, Iowa.—This invention has for its object to furnish an improved washing machine, simple in construction, convenient in use, and effective in operation, doing its work quickly and thoroughly, and without injury to the most delicate fabrics. A vertical shaft actuated by a spur wheel rack and lever causes vertical pins to rotate back and forth within the case, to agitate the suds and clothing. The legs of the case are attached to the case by armed sockets.

COMBINATION LEVER BRIDLE BIT.—Henry M. Cornell, of Brighton, Ill.—This invention consists in forming the bit of two parts fitted together so as to form a single round bit, and arranged to slide one upon the other so that tension on the reins will cause them to extend laterally from the animal's mouth while the bars or loops into which the reins buckle will be drawn toward each other as close as the animal's mouth will permit, producing a strong pressure, and at the same time making a double extension lever.

FOLDING BEDS.—Wendell Wright, of Bloomfield, N. J.—The object of this invention is to so construct a bedstead that it may be folded up in a small space, and at the same time be durable and simple in its parts, applying as well to spring bottom as to other bedsteads. Bedsteads may in this manner be manufactured and finished complete, and packed in very small compass for transportation, or for storing when not in use. The advantages of this improvement must be apparent to all.

HASP LOCK.—George Crompton, Jersey City, N. J.—This invention furnishes an improved trunk lock, so constructed as not to require the front of the trunk to be cut away to allow the lock to be attached. Its principal feature consists in the combination of a pivoted lock bar with the locking jaws which are pivoted to the hasp.

SINGLE HARNESS.—Charles Richard Stewart, Winslow, Me.—This invention has for its object to furnish an improved single harness for attaching a horse to a pair of thills, which shall be more comfortable for the horse, and which will give the horse a better control over the carriage. When the horse is pulling, the breeching will not be in contact with him, and, when holding back, the breast pads will be withdrawn from his breast, so that the only part of the harness that will be constantly in contact with the horse will be the supporting strap.

SEED DROPPER.—Joseph C. Barlow, Quincy, Ill., assignor to Vandiver Corn Planter Company, same place.—This invention is an improved out off for corn planters and other seeders, to brush off the superfluous grains after the holes or chambers of the dropping plate have been filled, and it is so constructed as not to injure or break the seeds. An arrangement of the two angular plates in juxtaposition to one another, and a combination of plates and springs, constitute the features upon which a patent has been obtained.

MACHINE FOR WRITING BLINDS.—James H. Nelson, of Little Falls, N. Y., assignor to himself and Byron K. Houghton, of same place. This invention consists in driving two staples across one another and successively into the slot and strip of a blind; also, in holding the slot; also, in certain improvements upon the operative mechanism, the latter of a nature that precludes a mere verbal description, but which forms a small, compact, and easily operated machine for the purpose intended.

CRUCIBLE FOR MELTING METAL.—Richard Yelding, Detroit, Mich.—The inventor provides the ordinary crucibles of plumbago or other substance with a flue or passage from the bottom to the top, for allowing the heat to act upon the center of the mass of metal contained in the crucible more directly than it otherwise can, the said passage to be surrounded by a shell or tube of the same material that the other part of the crucible is made of. He also grooves, indents, or constructs the sides or walls of the crucible, both inside and out, to form projections, to interlock with the paste or clay or other substance with which the crucible is coated, to cause the said coatings to be retained much longer than they now are, thereby preserving the crucibles much longer, and thus cheapening the cost of melting steel or other metals. He states that he finds in practice, by this improvement, that the crucibles are capable of being used from six to ten times as much as in the ordinary way, and that the metal can be reduced much quicker, and with considerably less fuel in crucibles having the passage through the metal holding space.

CARRIAGE WHEEL.—Isaac E. Bower, Bainbridge, Ga.—This improvement in the construction of the rims of carriage wheels consists in forming the rims of thin sheet iron or steel bent into the form of three sides of a rectangular figure or triangular shape, in cross section, with metal sockets for the ends of the spokes, said sockets being riveted to the tread of the rim when in rectangular form, but, when in triangular form, secured to the apex of the angle, or an extension of the sides meeting at the apex. These rims may be filled with wood rims if preferred, and will hold the said wood rims very securely. The triangular rim may have a vertical rim for bracing the center of the tire, said rim being bolted or secured between the flanges.

BURIAL APPARATUS.—William H. McGavran, Connetquot, Ohio.—The object of this invention is to economize labor in the lowering of coffins and the filling of graves. The invention consists in the arrangement of a receptacle for the earth dug out of the grave, and in the application thereto of a windlass for lowering the coffin. The earth receptacle or box has a slanting back and sectional removable front, so that after the coffin has been let down the front may be taken off and the earth allowed to flow freely into the grave until the same is closed. The burial box is made of wood or other material, of proper size for holding the earth dug from a grave. The back of the box stands inclined upon a narrow bottom. The front of the box consists of a series of sections or boards which can be removed. The ends of the boards have handles which fit into notches or recesses in the supporting posts of the box. Suitable hooks or catches are applied to the sides of the box for holding the boards in place. In brackets that project from the front of the box are the bearings of a windlass which can be turned by hand. The box is, on wheels, rolled to the place where a grave is to be dug, or is carried thither either together or in pieces, and then put together. The earth dug out is thrown into the box, the boards being put on upwardly as the box is filling. The coffin is placed upon sticks over the grave, as usual. Ropes or bands are then drawn under it, and fastened to the windlass, which is turned by hand to lower the coffin into the grave subsequent to the removal of the supporting sticks. The coffin having been let down, the lower board is taken off and the earth allowed to flow into the grave, filling it up. Enough earth will remain on the bottom for rounding the grave. More than the lower board may be taken off if it is desired to still more hasten the operation. By the use of this apparatus considerable labor is saved, so that two men will be enabled to perform the service for which four are now required.

CHAINS FOR WATCHES, ETC.—George W. Clappitt, Attleborough, assignor to Henry F. Barrows, North Attleborough, Mass.—This invention consists in fastening the ends of the staples used for connecting the links of wide gold or other chains by lapping the said ends by each other, and bending or hooking them over the outer row of rings in such manner as to accomplish the fastening by bending only, which saves considerable labor heretofore expended in soldering the ends of the staples together, the said ends being bolted against each other. It also saves the solder and much labor heretofore used in removing the discoloring of the edge of the chain exposed to the heat in soldering; and there are no soldered portions exposed to view, or parts discolored by solder. The final part of the bending is done by a punch struck by a hammer, which delivers a blow upon the chain edgewise in such manner as to shorten the staples and secure the links more closely together than they can be when soldered, thus making a more compact chain.

SEWING MACHINE.—Adam Barth and Nicholas Barth, St. Louis, Mo.—This invention consists in an improvement of sewing machine feed mechanism, the advantages to be gained by which are that it shall dispense with a presser foot, and with the friction consequent to the use of the same, and that it can be used, together with the lower feed, for crimping and ruffling on either side. A vertical slide carries the upper feed wheel, and is attached to a laterally adjustable bar. A wheel is connected by a chain with this upper feed wheel, and is combined with a lever, adjustable rod, and crank arbor, by which motion is imparted to the feed.

CHILDREN'S CARRIAGE.—Chauncey Holt, Jersey City, N. J.—The object of this invention is to provide a children's perambulator or carriage with a drawer, wherein to keep articles of food and other appliances that may be necessary or convenient for use of small children. The invention consists in the application of a drawer to a children's carriage, when arranged in the lower part of the carriage body in guides, and so that it can be operated by being drawn backward, forward, or to the side.

CULTIVATOR.—Jerome H. Tomlinson, of Mount Carroll, Ill.—The object of this invention is to so connect the plow beams with the axle bearings of the wheels that the lateral motion of the plows will be inversely followed by a similar twist of the wheels. By the arrangement employed, it is claimed that the operator has complete power to govern the side movement of the forward as well as the hind end of the plows, and crooked rows can be plowed with greater ease than without this device. The plow requires less care in driving, for the wheels will adjust themselves to keep always in front of the plows. No up or down movement of the plows, only their side movement, will affect the motion of the wheels. Whenever the team gets off the rows, it is only necessary to swing the plows aside, whereby the wheels are set so as to affect the motion of the wheel.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING NOVEMBER 21, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES:	
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Full information as to price of drawings in each case, may be had by addressing

MUNN & CO.,
Patent Solicitors, 37 Park Row, New York.

- 121,036.—STEREOTYPES.—F. H. Aiken, Franklin, N. H.
- 121,037.—REFRIGERATOR.—A. W. Almquist, Long Island city, E. G. Conradson, Brooklyn, N. Y.
- 121,038.—COMPOUND.—T. Bathy, Smith's Creek, Mich.
- 121,039.—TIGHTENING TIRES.—H. Beckwith, Grass Lake, Mich.
- 121,040.—JOURNAL BOX.—J. D. Beers, Phila., Pa.
- 121,041.—GALLEY.—J. F. Bronson, Waterbury, Conn.
- 121,042.—WASHER, ETC.—G. R. Clarke, New York city.
- 121,043.—THREAD KATE.—J. L. Demarest, Elmira, N. Y.
- 121,044.—COMPOSITION.—J. E. Dotch, Washington, D. C.
- 121,045.—FELTING MACHINE.—R. Eickemeyer, New York city.
- 121,046.—HEMMER.—H. A. Ellis, Albany, N. Y.
- 121,047.—COUPLING.—J. M. & J. Eos, St. Joseph, Mich.
- 121,048.—HORSE POWER.—L. R. Faught, Phila., Pa.
- 121,049.—CIGAR LIGHTER.—M. E. Gale, New York city.
- 121,050.—BRUSH.—H. A. Harvey, Orange, N. J.
- 121,051.—COUPLING.—J. B. Heverling, Greenville, O.
- 121,052.—PROPULSION.—J. A. Howell, U. S. Navy.
- 121,053.—STOVE.—S. Ketchum, Macon, Mich.
- 121,054.—BASKET.—J. Knapp, Coloma, Mich.
- 121,055.—LUBRICATOR.—C. Lynch, Detroit, Mich.
- 121,056.—KITE.—O. Maddaus, Brooklyn, N. Y.
- 121,057.—BENDING SKELPS.—G. Matheson, Boston, Mass.
- 121,058.—BENCH, ETC.—E. Milner, Strathroy, Canada.
- 121,059.—TOOL.—H. F. Moeller, H. P. Brandt, Davenport, Iowa.
- 121,060.—SCREW BOLT.—F. Mutimer, Rockford, Ill.
- 121,061.—HARVESTER.—P. Nicola, Massillon, O.
- 121,062.—SMOKE STACK.—T. B. Phoebeus, Memphis, Tenn.

121,063.—ROOFING.—O. J. Pierce, Worcester, Mass.
 121,064.—ENGINE.—E. H. Rees, Mansfield, O.
 121,065.—FILTER.—A. F. Schmidt, Davenport, Iowa.
 121,066.—MUTATION SCALE.—J. H. Scott, Kickapoo, Ill.
 121,067.—PITCH.—L. T. Stetson, Randolph, Mass.
 121,068.—EARTH CLOSET.—R. R. Strain, San Francisco, Cal.
 121,069.—BLACKING BOX.—A. M. Utley, Watertown, N. Y.
 121,070.—DESK, ETC.—W. Watson, Visalia, Cal.
 121,071.—TEA KETTLE.—A. F. Wolf, Beaver Falls, Pa.
 121,072.—TWEED.—A. M. Worthing, Reno, Nev.
 121,073.—FENDER.—C. C. Algeo, Pittsburgh, Pa.
 121,074.—BOILER.—F. S. Allen, C. F. Ritchel, New York city.
 121,075.—CAR WHEEL.—A. G. Barrett, Barrett, Kan.
 121,076.—FASTENER.—H. M. Bidwell, New Haven, Conn.
 121,077.—PIANO ACTION.—D. L. Bollermann, Mt. Vernon, N.Y.
 121,078.—TIRE MACHINE.—W. Bowden, White's Corners, N.Y.
 121,079.—GENERATOR.—A. D. Brock, Washington, D. C.
 121,080.—CHAIR.—H. Buchter, Louisville, Ky.
 121,081.—JACK.—W. S. Burgin, Washington, Va.
 121,082.—PAVEMENT.—C. Burlew, Washington, D. C.
 121,083.—WRENCH.—L. Chapman, Collinsville, Conn.
 121,084.—KNIFE.—T. M. Clarke, Winsted, Conn.
 121,085.—FANNING MILL.—D. Collins, Zanesville, O.
 121,086.—DUMP CART.—G. L. Collins, Trenton, N. J.
 121,087.—BALING PRESS.—J. S. Cook, West Groton, Mass.
 121,088.—SPIRIT LEVEL.—L. L. Davis, Springfield, Mass.
 121,089.—LAMP BRACKET.—R. S. Dennison, Winsted, Conn.
 121,090.—HARVESTER.—P. M. Donohoo, St. Rose, Wis.
 121,091.—URN, ETC.—W. J. Evans, New York city.
 121,092.—SKATE.—E. L. Fenerty, Halifax, Canada.
 121,093.—BOILER, ETC.—T. Flesher, Dunkirk, N. Y.
 121,094.—ROCKER.—J. N. Fowler, New York city.
 121,095.—WINDMILL.—H. H. Frank, P. Hansen, Richton, Ill.
 121,096.—KEY.—E. L. Gaylord, Bridgeport, Conn.
 121,097.—GRATE.—W. A. Greene, Brooklyn, N. Y.
 121,098.—SASH HOLDER.—J. C. Hanna, Rossville, Iowa.
 121,099.—STAMP.—T. C. Hargrave, Boston, Mass.
 121,100.—STUD.—A. Hartmann, New York city.
 121,101.—STOVE.—L. Hermance, Lansingburgh, N. Y.
 121,102.—TELEGRAPH.—R. Herring, Canonbury, England.
 121,103.—PISTON.—W. H. Holland, Boston, Mass.
 121,104.—PIPE ELBOW.—G. W. Howell, Covington, Ky.
 121,105.—SHINGLE MACHINE.—E. Hughes, Gowie, Can.
 121,106.—BARREL.—M. G. Huntley, Grand Rapids, Mich.
 121,107.—HARVESTER.—J. H. Keiler, Boalsburg, D. F. Luse, Center Hall, Pa.
 121,108.—CART.—J. Kling, Oswego, N. Y.
 121,109.—GOVERNOR.—A. K. Kline, Readington, N. J.
 121,110.—DICE.—A. Klingenberg, Baltimore, Md.
 121,111.—BED BOTTOM.—M. Kohn, Hartford, Conn.
 121,112.—CHAIR SEATING.—M. Kohn, Hartford, Conn.
 121,113.—HOIST.—S. L. Lord, New York city.
 121,114.—CULTIVATOR.—A. M. Manny, Lena, Ill.
 121,115.—CULTIVATOR.—A. M. Manny, Lena, Ill.
 121,116.—CORN PLANTER.—J. Matthews, Lincoln, Ill.
 121,117.—CUTTING CARDS, ETC.—V. E. Mauger, New York city.
 121,118.—CEMENT, ETC.—J. McKenzie, J. M. Stebbins, Phila., Pa.
 121,119.—GLASS, ETC.—G. F. Morse, New York city.
 121,120.—ROCK DRILL.—L. Nelson, Smyrna, Tenn.
 121,121.—PRESS.—J. D. Nix, Noble, Ill.
 121,122.—REGULATOR.—N. Nolan, New York city.
 121,123.—HARVESTER.—C. N. Owen, Salem, Ohio.
 121,124.—CARPET.—L. C. Palmer, Howard, Pa.
 121,125.—WINDMILL.—L. Patric, Springfield, Ohio.
 121,126.—COFFEE POT.—J. W. Patterson, New York city.
 121,127.—DRYER, ETC.—M. Power, Chicago, Ill.
 121,128.—FABRIC.—I. Behn, Washington, D. C.
 121,129.—ROAD DRESSER.—S. D. Reynolds, Rochelle, Ill.
 121,130.—PAPER PULP.—J. A. Rothe, Phila., Pa.
 121,131.—LET OFF.—C. Schilling, Auburn, N. Y.
 121,132.—LIFE PRESERVER.—T. R. Scott, New York city.
 121,133.—PRESS.—J. A. Sivley, Clarksville, Tex.
 121,134.—FILLING BARRELS.—F. Stitzel, Louisville, Ky.
 121,135.—LINE REEL.—C. H. Staffin, Boston, Mass.
 121,136.—WASHER.—G. C. Taylor, J. B. Crisman, Port Jervis, N.Y.
 121,137.—WATER WHEEL.—DeW. C. Teller, Fort Plains, N.Y.
 121,138.—SASH HOLDER.—C. T. Tessier, New York city.
 121,139.—CAN.—L. Thomas, Phila., Pa.
 121,140.—BRAKE.—I. Townsend, Capeville, Va.
 121,141.—WOOD PRESERVER.—J. G. Voorhies, Aqueduct Mills, N.J.
 121,142.—DOOR LOCK.—N. Warren, Wilmington, Del.
 121,143.—CRUSHER.—P. Wood, Jersey City, N. J.
 121,144.—SAWER.—W. M. Wright, Galesburg, Ill.
 121,145.—CAR SEAT.—J. M. Allen, Washington, D. C.
 121,146.—PAINT.—D. R. Averill, New Centerville, N. Y.
 121,147.—PAINT.—D. R. Averill, New Centerville, N. Y., J. Browning, Newburgh, Ohio.
 121,148.—BUCKET.—A. Bauman, Toledo, Ohio.
 121,149.—VISE.—J. D. Beck, Liberty, Pa.
 121,150.—BRAKE.—J. F. Brode, Memphis, Tenn.
 121,151.—PIPES.—A. T. Brodie, R. R. Smith, J. T. Tyler, Pitts'gh, Pa.
 121,152.—STOPPER.—M. W. Brown, New York city.
 121,153.—PLOW.—L. E. Burdin, Lexington, Ky.
 121,154.—CAN.—D. Burnet, Bedford Station, N. Y.
 121,155.—SAFE.—J. W. Case, Ypsilanti, Mich.
 121,156.—BOX.—J. Cohn, New York city.
 121,157.—ROLLER.—J. Cole, Fredericksburg, Iowa.
 121,158.—SWITCH.—C. L. Cooke, Shortsville, N.Y.
 121,159.—HAY RAKE.—L. A. Crockett, Wythe Co. Va.
 121,160.—PIPE MACHINE.—A. J. Davis, Newark, N. J.
 121,161.—LOOM.—H. G. Davis, Worcester, Mass.
 121,162.—TREATING FAT.—L. L. A. E. P. de la Peyrouse, Paris, Fr.
 121,163.—PROPELLER.—L. de Lill, Phoenix, N. Y.
 121,164.—STOVE.—N. Gergen, Buffalo, N. Y.
 121,165.—LAMP POST.—L. A. Gouch, Yonkers, N. Y.
 121,166.—ROOFING, ETC.—J. K. Griffin, Watertown, Canada.
 121,167.—LINE HOLDER.—J. B. Habecker, Newport, Pa.
 121,168.—CAN.—J. W. Hannan, Elyria, Ohio.
 121,169.—BED.—H. Hard, Akron, Ohio.
 121,170.—GAS HEATER.—D. G. Haskins, Cambridge, Mass.
 121,171.—SHOW CASE.—I. S. Hucksins, Wenona, Mich.
 121,172.—AX.—H. H. Parsons, Hoosick Falls, N. Y.
 121,173.—ELECTROMAGNETIC ENGINE.—S. S. Jones, N. Orleans, La.
 121,174.—RUBBER.—C. M. Kelsey, Mount Vernon, Ohio.
 121,175.—LOCK NUT.—S. T. Lamb, New Albany, Ind.
 121,176.—LOCK NUT.—S. T. Lamb, New Albany, Ind.
 121,177.—SHAFT TUG.—C. C. Lee, Falls Church, Va.
 121,178.—PULLEY.—A. Le Page, Woodhaven, N. Y.
 121,179.—KILN.—T. Lindsley, New York city.
 121,180.—ROLLS.—G. G. Lobdell, J. Megaw, Wilmington, Del.
 121,181.—GATE.—W. L. Ludlow, Cleveland, Ohio.
 121,182.—TROLLING SPOON.—J. H. Mann, Syracuse, N. Y.
 121,183.—KILN.—A. McBride, Lowell, Mich.
 121,184.—TRAVELER.—W. B. McClure, Alexandria, Va.
 121,185.—HEATER.—W. L. McDowell, Philadelphia, Pa.
 121,186.—SEWING MACHINE.—L. A. Merriam, New York city.
 121,187.—AXLE.—J. Montgomery, New York city.
 121,188.—GATE.—J. D. Morrison, Richfield, Ill.
 121,189.—TWEED IRON.—J. Nelson, Oswego, N. Y.
 121,190.—LADDER.—J. S. Oakley, Passaic, N. J.

121,191.—BOOK HOLDER.—H. A. Oesterle, Philadelphia, Pa.
 121,192.—SIEVE.—W. Page, Epsom, England.
 121,193.—BUILDING BLOCK.—M. R. Pierce, New York city.
 121,194.—FLASK, ETC.—L. T. Pyott, Philadelphia, Pa.
 121,195.—WATER WHEEL.—W. Road, Patterson, N. Y.
 121,196.—SHOW CASE.—W. H. Reiff, Philadelphia, Pa.
 121,197.—FLOUR SIFTER.—C. Richardson, Philadelphia, Pa.
 121,198.—CUTTER.—S. W. Robinson, Champaign, Ill.
 121,199.—FIRE ARM.—J. Rupertus, Philadelphia, Pa.
 121,200.—SCALES.—E. Sampson, Nassau, N. Y.
 121,201.—FAUCET.—J. Sargent and L. F. Munger, Rochester, N.Y.
 121,202.—CHECK REIN.—J. Schofield, Worcester, Mass.
 121,203.—WASHER.—J. J. Schroyer, Springfield, Ill.
 121,204.—CORN PLANTER.—L. Seofield, Watertown, Wis.
 121,205.—COMPOUND.—E. A. Shewell, Boston, Mass.
 121,206.—COFFIN.—J. H. Shields, Louisville, Ky.
 121,207.—PLOW.—G. B. Smith, Shopiere, Wis.
 121,208.—DRYER.—O. S. Smith, C. R. Hopkins, Middletown, Ct.
 121,209.—PUMP.—H. Spear, Portland, Me.
 121,210.—CORSET, ETC.—L. Spigelmyer, Easton, Pa.
 121,211.—METER.—D. B. Spooner, Syracuse, N. Y.
 121,212.—CAR.—W. Stark, White Pigeon, Mich., J. G. Fisher, and S. Fitch, Toledo, O.
 121,213.—CAR.—W. Stark, White Pigeon, Mich., J. G. Fisher, and S. Fitch, Toledo, O.
 121,214.—CAR.—W. Stark, White Pigeon, Mich., J. G. Fisher, and S. Fitch, Toledo, O.
 121,215.—SADDLERY.—J. Straus, St. Louis, Mo.
 121,216.—WASHER.—D. P. Sulouff, Milton, Pa.
 121,217.—WASHER.—D. P. Sulouff, Milton, Pa.
 121,218.—ALARM.—A. Taylor, Brooklyn, N. Y.
 121,219.—VAULT.—L. D. Tredway, St. Louis, Mo.
 121,220.—THRASHER.—P. Upton, J. B. Lobdell, Battle Creek, Mich.
 121,221.—TAG.—T. Van Kannel, Cincinnati, O.
 121,222.—GRAFTER.—D. S. Wagener, Putnam, N. Y.
 121,223.—DRILL BIT, ETC.—P. M. Ward, Cow Run, Ohio.
 121,224.—EYELET MACHINE.—G. Wunderlich, Philadelphia, Pa.
 121,225.—LINK.—S. F. Lamb, New Albany, Ind.

REISSUES.

4,638.—WRINGER.—R. B. Hugunin, Cleveland, O.—Patent No. 75,425, dated March 10, 1868.
 4,639.—SEWING, ETC.—A. Judson, Newark, N. J.—Patent No. 68,828, dated September 10, 1867.
 4,640.—CUT OFF.—J. E. McKay, New York city.—Patent No. 118,968, dated Sept. 12, 1871.
 4,641.—BOLT MACHINE.—J. Minter, Lowell, Mass.—Patent No. 45,521, dated July 12, 1864; reissue No. 2,003, dated Oct. 17, 1865.
 4,642.—HUB.—A. Warner, Hampden, Conn.—Patent No. 61, 830, dated Feb. 5, 1867.
 4,643.—HEATER.—S. F. Gold, Englewood, N. J., W. A. Fokett, New Haven, Conn.—Patent No. 36,000, dated July 29, 1862.
 4,644.—FURNACE.—A. H. Mershon, Philadelphia, Pa.—Patent No. 55,138, dated May 29, 1866.

DESIGNS.

5,365.—BADGE.—I. Bedichimer, Philadelphia, Pa.
 5,366.—HINGE.—F. W. Brocksieper, New Haven, Conn.
 5,367.—SHAWL.—S. Byrom, Philadelphia, Pa.
 5,368.—HANGER.—J. Herald, Unadilla, N. Y.
 5,369 and 5,370.—MANGERS.—J. L. Jackson, New York city.
 5,371.—JAR.—J. J. Jepson, West Meriden, Conn.
 5,372.—CARPETS.—J. H. Smith, Enfield, Conn.
 5,373.—LOCK CASE.—B. Steinmetz, Paris, France.
 5,374.—JAR.—H. C. Wilcox, West Meriden, Conn.
 5,375 and 5,376.—CARPETS.—A. Heald, Philadelphia, Pa.
 5,377.—PEN, ETC.—E. S. Johnson, New York city.
 5,378.—IRON POST.—M. D. Jones, Boston, Mass.

TRADE MARKS.

545.—MEDICINES.—W. A. Bishop, Dodgeville, Wis.
 546.—MUTILAGE.—Carter Brothers & Co., Boston, Mass.
 547 to 549.—BRANDY.—Ives, Beecher & Co., New York city.
 550.—WHISKY.—C. H. Ross & Co., Baltimore, Md.
 551.—GIN.—T. L. Smith, Boston, Mass.
 552.—SEWING MACHINE.—The Remington Empire Sewing Machine Co., Ithaca, N. Y.

APPLICATIONS FOR EXTENSION OF PATENTS.

HYDRAULIC VALVE.—Helen Woodward, Lowell, Mass., administratrix of Calvin Woodward, deceased, and George W. Woodward, New York city, have petitioned for an extension of the above patent. Day of hearing, January 31, 1872.

HORSE RAKE.—William Horning, New Lebanon, Ohio, has petitioned for an extension of the above patent. Day of hearing, February 7, 1872.

STRAW CUTTER.—Thomas H. Willson, Philadelphia, Pa., and Daniel T. Willson, Harrisburg, Pa., have petitioned for an extension of the above patent. Day of hearing, February 7, 1872.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is \$100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

MUNN & Co., 37 Park Row.

Inventions Patented in England by Americans.

From October 31 to November 6, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

BATTERY GUN.—R. J. Galling, Hartford, Conn.
 DISINFECTANT.—J. E. Dotch, Washington, D. C.
 DISTILLING NAPHTHA, ETC.—C. Pratt, Brooklyn, N. Y.
 DOLL.—National Toy Company, New York city.
 ENGINE.—T. H. Wagstaff, New York city.
 FERRULE, ETC.—T. H. Alexander, R. and F. G. Clarke, New York city.
 HAND STAMP.—J. M. Tower, New York city.
 ORNAMENTING GLASS.—G. F. Morse, New York city.
 PLAISTERS.—B. Brandreth, New York city.
 PURIFYING WATER, ETC.—W. C. Selden, Brooklyn, N. Y.
 RUFFLER.—A. H. Cramp, Brooklyn, N. Y.
 TREATING COTTON SEED.—J. J. Powers, Memphis, Tenn.
 TWINE CUTTER.—C. C. Lewis, Gainesville, Ala.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 35,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

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

Preliminary Examination.

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

Caveats.

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

To Make an Application for a Patent.

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

Re-issues.

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

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application, by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Design Patents.

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

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

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

European Patents.

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