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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.

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 machine. 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 from a compressor, also on exhibition, and has formed a very interesting feature of this year's display.

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 (miscalled 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 18¼ inches, and it weighs 166¾ 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 M'Cullough 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 coruscations 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 lifting force at between thirty and fifty tuns! 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' thunk 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 (Allis)	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	....	....
Whitney	21 00	3 00	18 00
Joslyn-Tomes	24 00	1 00	23 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 inexpert 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 433-1000 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 5·96, 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 to-day 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 infiltering 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 wer 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 climed 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 runs 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 ant 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 Lethean 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 muddied 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.
1. Anophthalmus Telemaii.
2. Beetle, No. 2.
3. Beetle, No. 3.
4. Phalangopsis, No. 1. } Crickets.
5. Phalangopsis, No. 2. }
6. Fly, No. 1.
7. Fly, No. 2.
8. Ephemera—larva-like.

b. Arachnida. (Spiders).
9. Opilio-like.
10. Aranea-like.

c. Myriapoda.
11. Pselaphotremis-like.

d. Crustacea.
12. Astacus (blind crawfish).
13. Astacus with eyes.
14. Grammarus-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 vail 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 climed 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 oxidisation of the sulphurous anhydrate by the oxygen of the air, and the oxidisation 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 anhydrate 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 Türner 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. Siebeneck, 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 vieing 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.

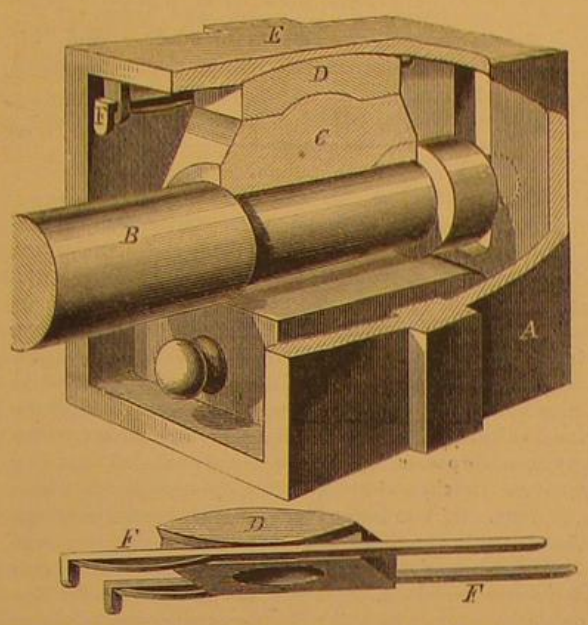
THE HUMBOLDT MONUMENT AT ALLLEGHENY CITY PA.

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 frailer still. The hinges, of the massive portals 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 records 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]

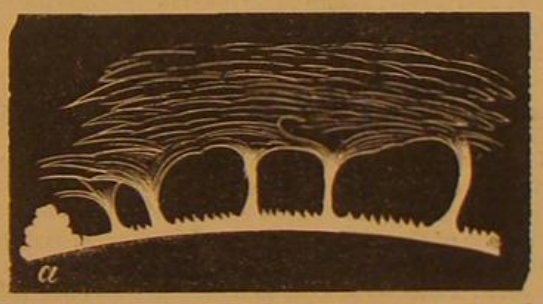
On the 7th of September, between half past twelve and two P. M., there occurred an outburst of solar energy remarkable for its suddenness and violence. Just at noon the writer had been examining with the telespectroscope* an enormous protuberance, or hydrogen cloud, on the eastern limb of the sun.

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 hight 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 *débris*—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 hight 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 I am particular in the statement because, so far as I know, chromospheric matter (red hydrogen in this case) has never been observed at an altitude exceeding 5′. The velocity of ascent also, 166 miles per second, is considerably greater than anything hitherto recorded. A general idea of its appearance, when the filaments attained their greatest elevation, may be obtained from Fig. 2. As the filaments rose they gradually faded away like a dissolving cloud,

FIG. 2.

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 hight; 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 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.

FIG. 4.

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.

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

† The chromosphere (called also *sierra* 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 4th; the three rolls in that are nearly exact.

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 onwards for 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 or 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.

Insomuch, 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.
JAMES D. WHELPLEY.

Boston, Nov. 1, 1871.

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 horses, 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 *Thysanaura* (Leach), and genera of *Lepisma, Forbicina, Petrobius, Podura*. Of this latter there are a great number of species, as well as in the genus *Smynthurus*, which two were united by Fabricius as identical. In Rees' "Cyclopedia" 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 Maunder's "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 Linnæus, 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 *Aphanipterous* orders—name, Greek, "unseen" and "wing." The apterous haustelate insects have rudimental 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 Mailer 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 hight, which hight 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.

L. E.

Macon, Miss.

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 per centage 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; consequently 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 Pianoforte.

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:

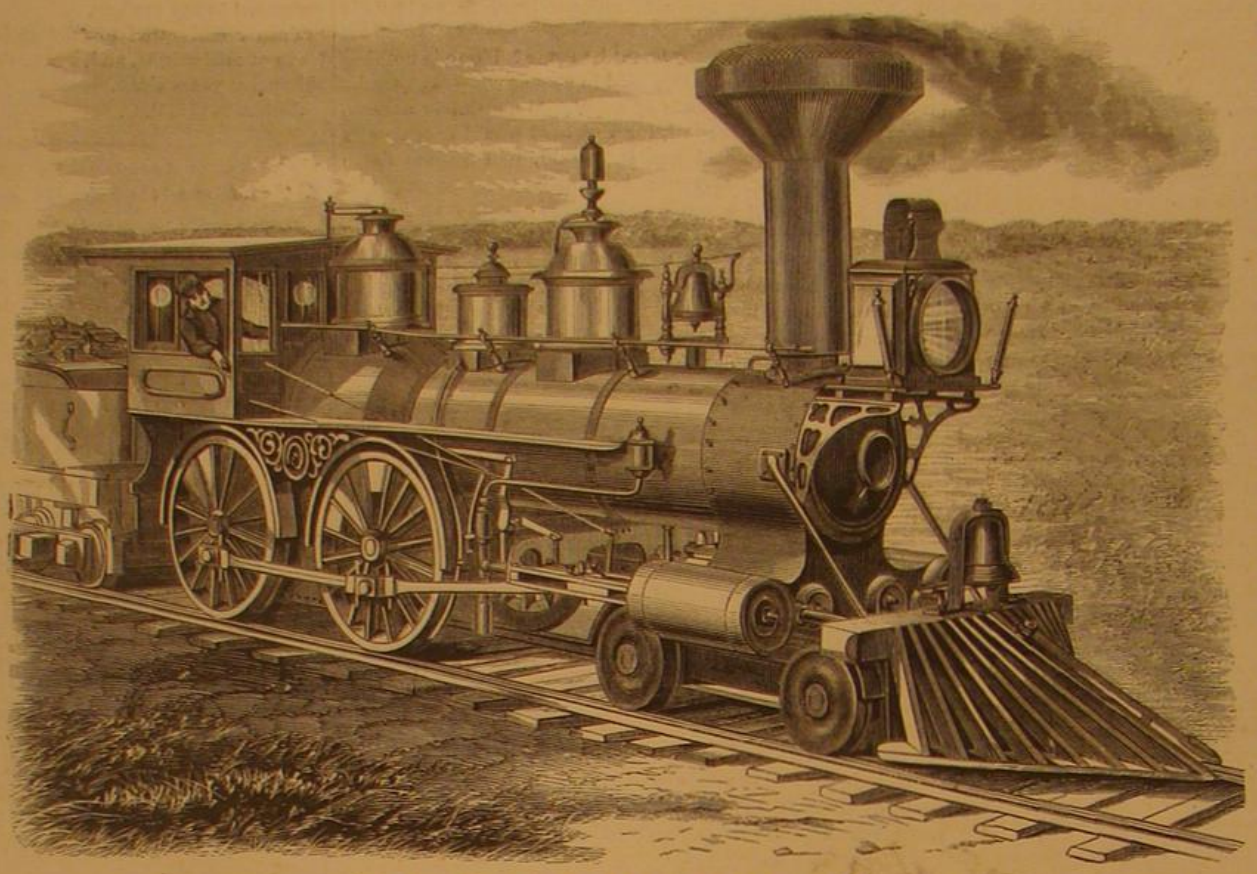
"I have just returned from a visit to the cundurango region, in the province of Loja, where I spent a month in collecting the different species of the plant. Dr. Destruge, of this city, an excellent botanist, has classified the vine as belonging to the order *asclepiadiæ*. The word 'cundurango' is a 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.



BRISCOE'S LOCOMOTIVE ALARM BELL.

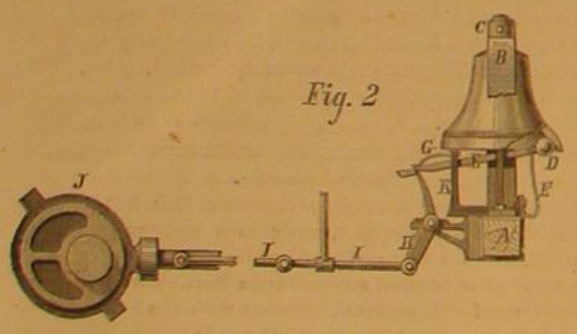
The inventor, Mr. B. Briscoe, Mechanical Superintendent of the Detroit and Milwaukee Railroad and Steamship line, writes us that these bells have been placed on the engines of that road, 34 in all, and he has no doubt but that it has prevented many accidents, and perhaps saved many lives. He says that 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.

Fig. 2



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.

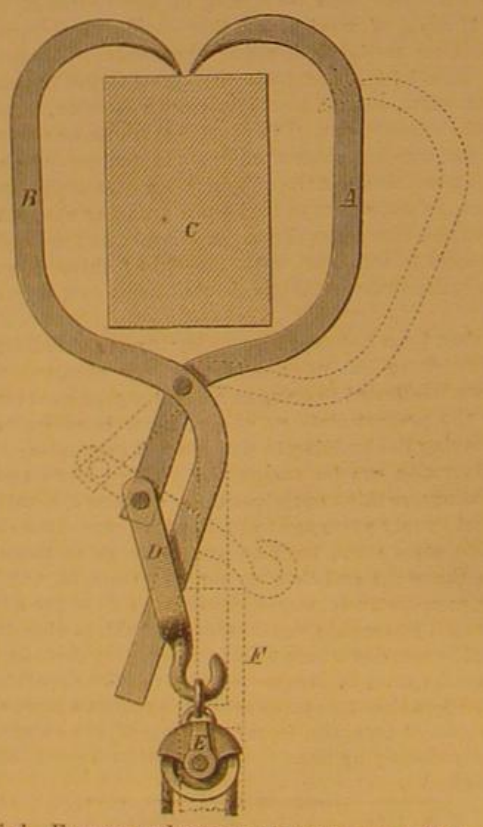
The locomotive being in operation, the revolutions of the eccentric communicate a rocking motion to the lever, H, by means of the connecting rod. The upper end of this lever engages with a notch on the lower side of the lever, E, thereby withdrawing the hammer head from the side of the bell, and compressing 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 apparatus, 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 becames 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 *scoriæ*, 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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Contents:

(Illustrated articles are marked with an asterisk.)

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 27° Fahrenheit for every thousand feet; and the theory that the hightened 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 pœan; 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 merchandize 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 aught 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, 1853.

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 granting 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.

Figuier 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, napththa, 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 severally 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 *bonâ 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 22d 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.

CARTTER, 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 arrangemen 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 $1·00 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 silex), of a strupy consistency (40° 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 hight of 33⅞ feet (perpendicular); 10 feet horizontal is equal to one foot perpendicular. So that the same pump will bring water 338½ feet horizontally, although in his particular case it will not operate, because he has 145 feet horizontal and 20 feet perpendicular, which makes over 34 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.

INCRUSTATION 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 incrusted. 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.—I. 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, $13,340: in 1866 she earned $4,250; in December, 1867, $435. The machine has been constantly employed since 1861 without a cent for repairs.

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.

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. Seligman, 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.
PURIFIER.—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 smokestack 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?—R. 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 homœopathic 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 INCRUSTATION IN BOILER.—I notice in a late number of SCIENTIFIC AMERICAN, an article recommending the use o 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 dualin 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 decandria*) 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.—WHITEWASH 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 jointed 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 canted, 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 Giebrich, 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 verbally 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 Huntsville, 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. McBride, 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. Towner 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 Cuming, Jr., of Brookhaven, Mississippi.—This invention consists in a combination with the mold board and landside of a turn-plow, and of an adjustible share arranged between them.

DRYER.—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 Booze, 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 mash 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 guiders 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.

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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 SAFES.—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. Hirons, Buchanan, Mich.
120,586.—PISTON.—O. S. Howard, Bangor, Me.
120,587.—BED BOTTOM.—C. Johnson, Chicago, Ill.
120,588.—MACHINE GUN.—G. O. Kinne, Hartford, Conn.
120,589.—PLANER.—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.
120,593.—LATHE.—J. E. Miller, Birmingham, Pa.
120,594.—DOVETAIL MACHINE.—O. J. Penneil, G. Zimmer, Williamsport, Pa.
120,595.—INSECT TRAP.—C. E. Penny, Fort Wayne, Ind.
120,596.—EXTRACTING OILS.—G. G. Percival, Waterville, Me.
120,597.—AIR COMPRESSER.—W. E. Prall, Washington, D. C.
120,598.—WAGON.—T. H. Prushaw, Fredonia, N. Y.
120,599.—BED.—J. H. Sherman, Galesburg, Ill.
120,600.—NECK TIE.—E. Side, Brooklyn, N. Y.
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, Barbourville, Ky.
120,606.—TANNING HIDES.—H. P. Wilson, New York city.
129,607.—HANDLE.—F. Alsip, North McGregor, Iowa.
120,608.—ARCH.—F. Alsip, North McGregor, Iowa.
120,609.—REGISTER.—A. P. Atkinson, Vermont, Ill.
120,610.—COUPLING.—A. A. Atwater, Trumansburg, N. Y.
120,611.—ENGINE.—T. Aveling, Rochester, Eng.
120,612.—PRESS.—G. H. Aylworth, Brighton, Ill.
120,613.—VAPOR BURNER.—S. D. Baldwin, Chicago, Ill.
120,614.—SEWING MACHINE.—A. and N. Barth, St. Louis, Mo.
120,615.—CARDING CYLINDER.—H. Bennett, Waterbury, Conn.
120,616.—BUSTLE.—I. W. Birdseye, Birmingham, Conn.
120,617.—HAT BODY.—P. V. W. Bishop, Morristown, N. J.
120,618.—TOOL.—L.C.Butch, Lancaster, A. F.Thoma, Piqua, O.
120,619.—CHAIN LOCK.—L. F. Cahn, New York city.
120,620.—BASKET.—H. Carpenter, Williamsburg, N. Y.
120,621.—SCALE.—B.E.Chassaing, Buenos Ayres, Argent. Rep.
120,622.—MOTION.—J. J. Chenal, Génissiat, France.
120,623.—CHAIN.—G. W. Clampitt, Attleborough, Mass.
120,624.—BEE HIVE.—W. R. Clark, Piqua, Ohio.
120,625.—CARTRIDGE.—J. W. Cochran, New York city.
120,626.—HAY TEDDER.—J. K. Collins, Hartford, Vt.
120,627.—VAPOR BURNER.—J. Cook, New York city.
120,628.—SOLE, ETC.—L. Coté, St. Hyacinthe, Canada.
120,629.—VENTILATOR.—W. Dale, New York city.
120,630.—CARTRIDGE.C.F.&J.E.de Dartein, Strasbourg, France.
120,631.—COMPOUND.—G. M. Denison, Essex, Conn.
120,632.—SEAT.—F. W. Dickerman, New York city.
120,633.—SAW.—W. L. Earing, Oswego, N. Y.
120,634.—BAND.—J. S. Everitt, C. H. Avery, Oshkosh, Wis.
120,636.—WASHING MACHINE.—J. Fox, Farmersville, Iowa.
120,637.—FUNNEL.—B. French, Rochester, N. Y.
120,638.—SPARK ARRESTER, ETC.—G.H.Griggs, Worcester, Ms.
120,639.—PAPER FOLDER.—R. R. Gubbins, Troy, N. Y.
120,640.—COUPLING.—J. Hale, Somerville, Mass
120,641.—WRENCH.—I. S. Hamilton, Hamilton, Ohio.
120,642.—CUTTING LEATHER.—L.D.Hawkins, Stoneham, Mass.
120,643.—CORN PLANTER.—A. Hearst, Peoria, Ill.
120,644.—BUGGY.—J. C. Hilsabeck, Montovallo, Mo.
120,645.—CARRIAGE.—C. Holt, Jersey City, N. J.
120,646.—PRINTING PRESS.—B. Huber, Williamsburg, N. Y.
120,647.—DASH BOARD.—A. B. Hurd, Painted Post, N. Y.
128,648.—TREADLE BRACE.—G. H. Hurd, Memphis, Tenn.
120,649.—CORN PLANTER.—B.Ingebrigtson, Cambridge, Wis.
120,650.—CAT BALL.—T. H. Joyce, New York city.
120,651.—BATTERY.—E. J. Leland, Worcester, Mass.
120,652.—TWINE CUTTER.—C. C. Lewis, Gainesville, Ala.
120,653.—OIL CAN.—D. D. Mackay, Whitestone, N. Y., C. Butler, New York city.
120,654.—SEWING MACHINE.—G.W. Manson, New York city.
120,655.—PUMP.—J. Marquis, San Francisco, Cal.
120,656.—ORNAMENTING, ETC. W.H.McElcheran, Hamilton, Ca.
120,657.—BURIAL APPARATUS. W.H.McGavran, Connotton, O.
120,658.—PICK, ETC.—D. McNally, Mount Savage, Md.
120,659.—ENAMELING MOLDINGS.—T. Moore, Boston, Mass.
120,660.—LUBRICATOR.—D. F. Mosman, Chelsea, Mass.
120,661.—STEAM ENGINE.—J. Neuert, Sandusky, Ohio.
120,662.—KEY.—J. F., P. W. O'Sullivan, Jackson, Miss.
120,663.—BLACKING BRUSH.—G. R. Owen, Utica, N. Y.
120,664.—VALVE.—S. J. Peet, Boston, Mass.
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RE-ISSUES.

4,621.—CARRIAGE TOP.—S. L. Barnett and Simon Beery, Urbana, Ohio. Patent No. 32,126, 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. 59,089, 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. 81,837, 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. Chace, New York City.—Patent No. 101,430, dated April 5, 1870.
4,629.—HARVESTER.—J. H. Keller, Boalsburg, Pa.—Patent No. 108,912, 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. 117,486, dated July 25, 1871.

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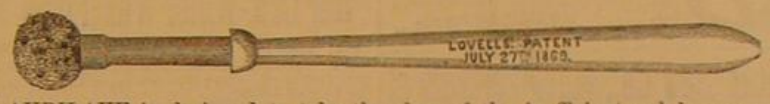

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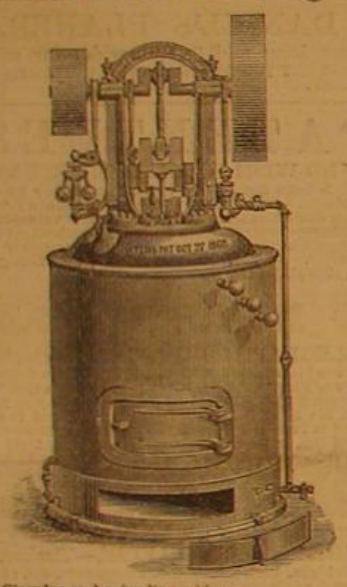

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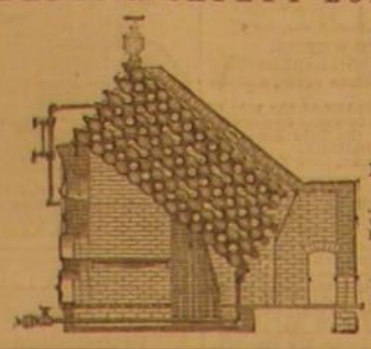

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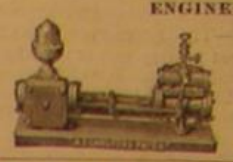

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