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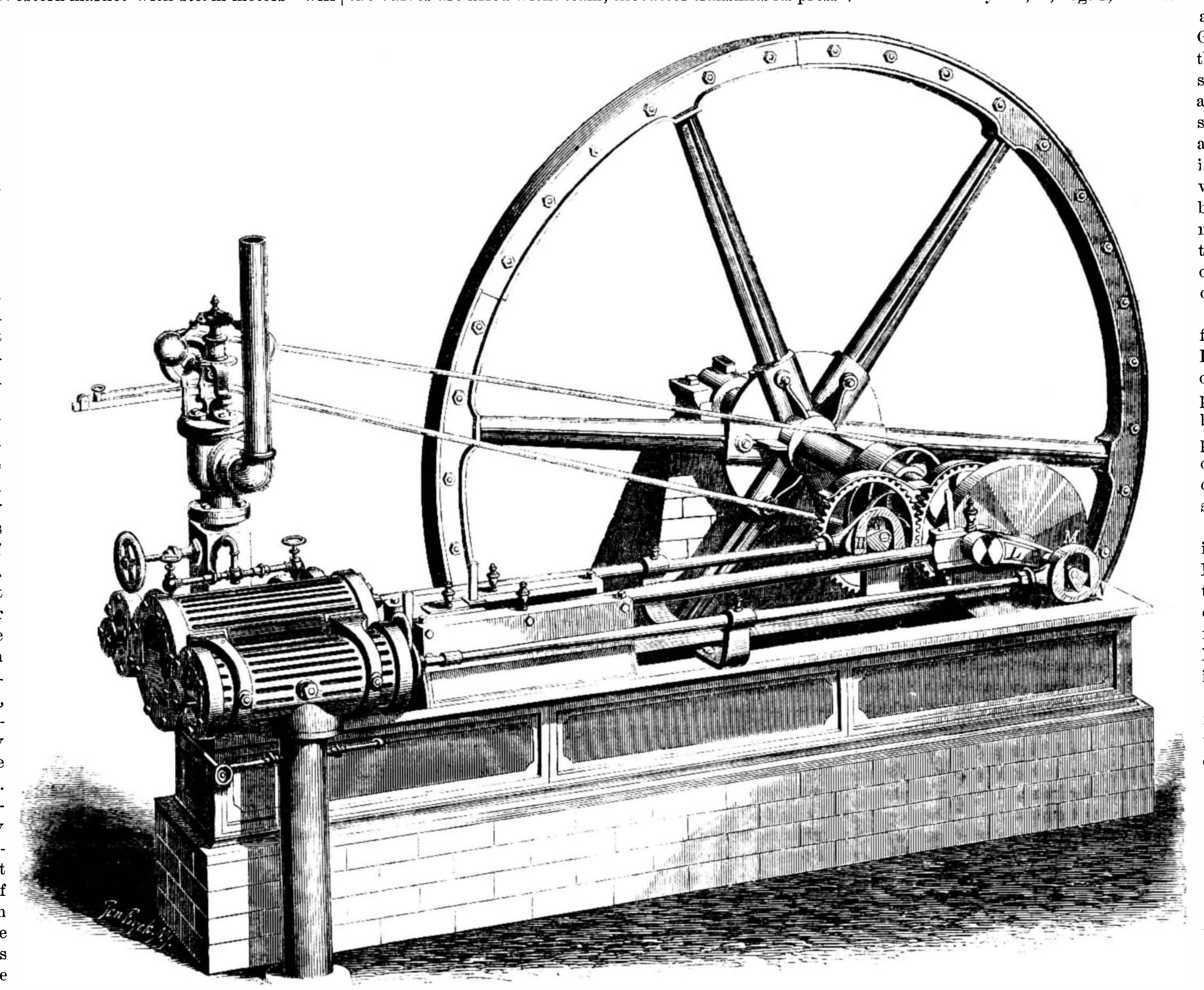
The Estes Steam Engine.

This is a Leavenworth (Kansas) engine. Our Eastern readers—manufacturers of engines especially, who for so long a time have supplied the Western market with steam motors—will look with curiosity at an engine built in the far West and which displays in its design and construction all the refinements of modern practice.

The engine is provided with variable cut-off, full stroke exhaust, and Tremain's balance valves. The piston is also furnished with Estes patent piston packing device, all of which are hereafter described. Economy of fuel, ere the railroads had made such inroads upon the timber supply of the country, was a consideration of little importance. The increasing cost of fuel from year to year, and the close competition in all kinds of manufacturing business, now render it imperative that every avenue of waste shall be closed. From being a question of secondary importance, economy of fuel is fast becoming one of primary interest in many parts of the country. It thus happens that the demand throughout the West for finer engines is annually becoming greater.



THE ESTES STEAM ENGINE.

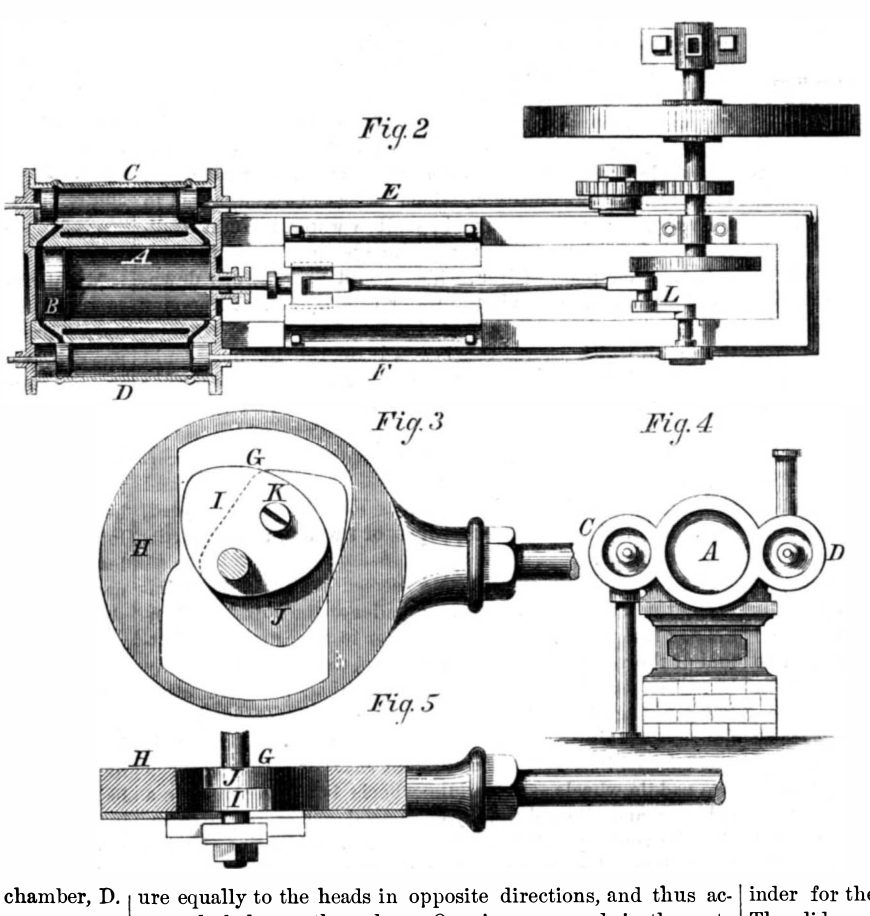
It is claimed for the Estes engine that it meets this growing want, and that not only economy of fuel but economy in first cost and in current expenses for repairs, are also secured by the simple and strong construction of its working parts; and also that while its working will compare with any of the more expensive engines in market, it will not give trouble and annoyance by the necessity of frequent repairs.

A detailed description of the improvements combined in the engine will show the grounds upon which these claims are based.

Fig. 1 is a perspective view, from which our readers will gain a good idea of the general design as well as most of the details of the construction. Fig. 2 is a plan view, with sectional view of the cylinder and valve chambers, showing the induction and eduction ports and valves, etc. Figs. 3, 4, and 5 are respectively an elevation and a section of the cam, which operates the induction valve, a section of the cylinder and valve chambers and a section of the beam. Figs. 6 and 7 show the method of packing pistons employed, to which we shall call special attention in the proper place.

A, Fig. 2, is the cylinder, B the piston, C the steam chest or chamber, D the exhaust chamber. These chambers are cylinders attached to opposite sides of the cylinder, A, and of the same length as A. The induction ports are shown on the side of the cylinder next to the steam chamber, C, and the eduction ports on the other side communicating with the exhaust chamber, D. These ports are entirely distinct from each other.

Each chamber has a double piston valve, consisting of two heads connected by a rod, as shown, the heads working in suitable seats. The course of admission and exhaust will easily be traced in the section of the cylinders without further description. When the steam spaces between the heads of the valves are filled with steam, the latter transmits its pressure equally to the heads in opposite directions, and thus accurately balances the valves. Openings are made in the seats which allow the steam to pass under and lessen the friction of the valves



The induction valve is worked by the rod, E, and the exhaust valve by the rod, F. The former is connected with the adjustable steel-pointed cam, G, Figs. 1, 3, and 5, which cam revolves in the yoke, H, Fig. 1, to which the valve rod, E, is attached. The cam, G, is attached to the end of a small shaft sustained by a bracket, which shaft is turned by a pinion meshing into a gear wheel, with an equal number of teeth, on the main shaft, so that the cam revolves once for every revolution of the shaft.

The cam, G, is formed in two parts, I and J. By means of the screw, K, the position of I may be varied on the part J, so as to cut off the steam at any desired point of the stroke.

The exhaust valve is moved by a crank, L, Figs. 1 and 2, on the end of the wrist of the pitman, by means of the cam, M, Fig. 1, working in the yoke, N.

The inventor does not confine himself to the use of cams exclusively for moving either of the valves; eccentrics may be used if desired.

The exhaust is kept open during the entire stroke, thus obviating all back pressure upon the piston. The cam and yoke, working the exhaust valve, make one full stroke backward and another forward during each revolution of the main shaft. Its movement being short is quickly made, and it then moves loosely in the yoke until the piston has made the full stroke, so that no back action takes place, no matter at what point the steam is cut off.

Figs. 6 and 7 are respectively a perspective view and a section of a piston packed by the Estes system. A are the packing rings, which are of the ordinary kind. Within these rings is placed a parted ring, B, with a wedge-shaped section as shown in Fig. 7. Within the ring, B, is another parted ring, C, also with a wedge-shaped section, the lower edge being cut off somewhat as shown, and so placed that its inclined face acts upon the inclined face of the ring, B; D is the annular base of the ring, E the radial braces of the piston head, and G the follower. When the latter is forced toward the head by the screws, F, the ring, C, is forced inward, expanding the ring, B, and through it the packing rings, A.

The chests are cast with the cylinder in one piece. All joints are ground in. The valves being cylindrical, a much larger area of opening is produced in the same length of travel than can be obtained by any flat slide valve. The valves are so constructed that they clear themselves of any sediment that may work through from the boiler in consequence of foaming or surplus of water, the rings being surrounded by steam and working half over the seats at every stroke. Each engine is provided with extra starting valves on each end of the cylinder for the purpose of starting the engine off its center. The slides are completely boxed in to prevent dirt from getting on the wearing parts, and each slide is provided with four brass gibs which can be readily packed up to a gage mark. The main wearing parts are provided with patent oilers. The fly wheel is made in segments, all the joints being planed to fit perfectly. Each bolt in the hub is turned and chased, and every hole reamed, leaving no possible room for play. A hollow wrought iron pitman is used instead of the usual solid rod.

We have thus attempted to place before our readers the peculiarities of this engine of the West. Its merits are spoken of in terms of high praise by parties now using it in extensive establishments.

The improvements described are covered by two patents obtained through the Scientific American Patent Agency by Philip Estes. The patents are dated respectively Feb. 28, 1871, and May 2, 1871.

For further information address Great Western Manufacturing Company, Leavenworth, Kansas.

Fig. 6

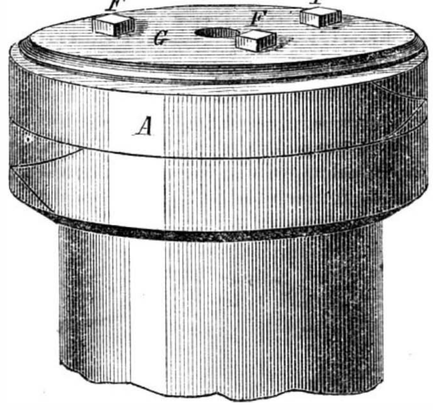
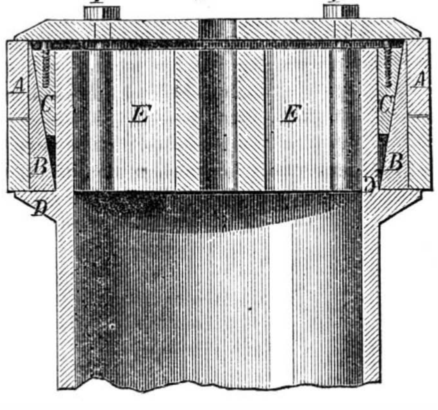


Fig. 7



The General Oceanic Circulation.

The temperature soundings, taken in the Lightning and Porcupine Expeditions, with trustworthy instruments, have shown:—(1.) That in the channel of from 600 to 700 fathoms depth which lies between the North of Scotland, the Orkney and Shetland Islands, and the Faroes, there is an upper stratum of which the temperature is considerably higher than the normal of the latitude; while there is a stratum occupying the lower half of this channel, of which the temperature ranges as low as from 32° to 29°·5; and a "stratum of intermixture" lying between these two, in which the temperature rapidly falls—as much as 15° in 100 fathoms. (2.) That off the coast of Portugal, beneath the surface stratum, which (like that of the Mediterranean) is superheated during the summer by direct solar radiation, there is a nearly uniform temperature down to about 800 fathoms; but that there is a "stratum of intermixture" about 200 fathoms thick, in which the thermometer sinks 9°; and that below 1,000 fathoms, the temperature ranges from 39° down to about 36°·5. (3.) That in the Mediterranean the temperature beneath the superheated surface stratum is uniform to any depth; being at 1,500 or 1,700 fathoms whatever it is at 100 fathoms, namely from 56° to 54°, according to the locality. To these may be added (4) the observations recently made by Commander Chimmo, with the like trustworthy thermometers, which, in lat. 3° 18½'S., and long. 95° 39' E., gave 35°·2 as the bottom temperature at 1,806 fathoms and 33°·6 at 2,306 fathoms. These seem to be the lowest temperatures yet observed in any part of the deep ocean basins outside the polar area.

It is clear, therefore, that very strong evidence now exists, that instead of a uniform deep sea temperature of 39°, which on the authority of Sir James Ross, by whom the doctrine was first promulgated, and of Sir J. Herschel, by whom it was accepted and fathered, had come to be generally accepted in this country at the time when the recent deep sea explorations commenced, not only is the temperature of the deeper parts of the Arctic basin below the freezing point of fresh water but the temperature of the deepest parts of the great oceanic basins, even under the equator, is not far above that point. And it seems impossible to account for the latter of these facts in any other mode, than by assuming that polar water is continually finding its way from the depths of the polar basins along the floor of the great oceanic areas, so as to reach or even to cross the equator. And as no such deep efflux could continue to take place without a corresponding in-draught to replace it, a general circulation must be assumed to take place between the polar and equatorial areas, as was long since predicted by Pouillet.—*Nature.*

DISCUSSION ON MR. HARDING'S PAPER, ENTITLED "THE APPLICATION OF STEAM TO CANALS," CONCLUDED IN OUR LAST ISSUE.---NO. 1.

Mr. Hyde Clarke said he might contribute a small personal portion to the history of the subject, having been one of the minor actors in this movement from about 1836 to 1840, when he was one of those who had the misfortune to be an inventor, although, happily, he had escaped figuring in the satirical list given in the paper, which was probably owing to his having escaped the hands of their friend, Mr. Newton, the patent agent. He recollected that, being a young man, he gave his own views without much reference to what other people had done, and some of his first publications on the subject, in the *Railway Magazine*, having attracted some attention, he was attacked by a leading man in Liverpool, who accused him of plagiarizing his ideas. Since that time, he had always been very careful how he published anything as original; but it always happened that when any subject of real importance was engaging the attention of the public, a number of persons were engaged upon it, and each thought himself the first, and was ready to treat any of his contemporaries who broached the same ideas as having borrowed them from him. His attention had been attracted to the subject from having seen the great advantage to traffic in the Netherlands, which had been developed for centuries, and in his early days it was a regular part of the tourist's scheme to make a journey by the canal boat. It was always recommended by the "Murray" of that day; and, though there were no Cook's tourists then, those who did venture abroad generally made a rule to carry out, at any rate, that portion of the programme. When so large a portion of the passenger traffic was carried in that way in Holland, he could not but contrast it with our own canal system, although at that time a certain number of passengers did avail themselves of that means of transit, even on the Grand Junction Canal. His branch of practice, then, as a railway and hydraulic engineer, led him to turn his attention upon the subject, and he was put in communication with some of the leading men in the canal interest, and the late Mr. Richard Walker, M. P. for Bury, took an active part in promoting his views. The difficulty, however, was to move the canal interest. At that time, they hardly believed that railways would be carried out, the whole landed interest being arrayed against them; but it was even then held by many eminent men that canals should be utilized to a much greater extent even than they were, but they would never stop railways, any more than they would ordinary roads. That necessity existed then, and it existed none the less now, when the commerce of the country was so much developed, and there was a great field for the extension of the same enterprise in India. At that time, in 1837 and 1838, the case was fully proved by many eminent men, who turned their attention to the subject, but the prejudice among the canal directors it was impossible to make head against. It was proved that a high speed could be obtained without injuring the canals, but the system was then in a transitional period, the directors being principally half superannuated, or the successors or sons of the old directors, and the companies either paying very good dividends or very bad ones, the directors were not inclined to make any outlay in such a way. Although he had long since ceased to take an active interest in such a subject, he must say it was one well worthy of attention, and he hoped it would be taken up in a practical way by those who were competent to deal with it and could influence public opinion.

Mr. Newton said, he should like Mr. Harding to give fuller information on the peculiar construction of the propeller, which he considered was so peculiarly eligible for canal navigation. It was not described in sufficient detail in the paper, and he hardly understood its peculiarities from the diagram.

Mr. Harding said, the propeller was constructed rather differently to those in ordinary use. The propeller was four and a half feet in diameter, with six and a half pitch. The peculiar construction of the blades, as shown in the drawing, was for the purpose of getting a strong pull on the water. The propeller, being in the bow, drew the boat along, and insured the water reaching it without any obstruction, or any of the difficulties which had been found in the case of propellers at the stern. In fact, on looking over some papers read in the early season of 1867, before the Institution of Civil Engineers, it was mentioned that one great disadvantage of propellers in canal boats being placed at the stern was, that if the space between the boat and the bottom of the canal were not sufficient for a quick passage of water, a large amount of force would be expended in churning the water against the bottom of the canal. Now, in this boat, that difficulty would be obviated. The water passed down the sloping channel under the boat, and along the bottom to the stern; the force was dissipated by the time the broken water reached the surface, so that there was no lateral wave. If there were any objection, which he had not seen, urged to the water being forced down in shallow water, it could readily be obviated by putting across the opening, under the propeller, a thin plate of iron, which would prevent any downward action, and pass all the water directly aft. The water was distributed so evenly, that if there were a strong wind on the canal, which canted the boat a little, the bubbles could be seen rising up a little on the weather side. The cylinder of the engine was eight inches in diameter, and they consumed a tun of coal in each twenty-four hours, which gave a speed of three miles an hour, with two hundred tuns of cargo. He had seen a boat, loaded to almost that extent, and towing another boat with an equal load, keep up a speed, including lockages and stoppages, of two and three fourths miles an hour.

Mr. Newton said, Mr. Harding seemed to consider the important point was to place the propeller at the bow, in a channel so arranged as to cause the water to pass under the bottom of the vessel and rise at the stern, thus preventing any lateral wash. He recollected an invention, patented some few years ago by an American gentlemen, whose name he did not recollect, in which the same thing was done, though it was effected in a somewhat different manner. He employed two paddle wheels, the paddle wheels being enclosed in a cylinder, and allowed to project beyond, and were placed inside the vessel, parallel with the keel. By actuating the cylindrical paddles, they acted on the water below, and there being a space left for them to project, they threw the water back, just in the way Mr. Harding had explained, the effect being that the vessel was propelled along without causing any lateral wash. The invention was tried in the north of England, and was found successful; but, owing to the difficulty of moving canal companies, referred to by Mr. Hyde Clarke, and the inventor being obliged to return to America, the invention had not been practically carried out to any extent. With reference to the system of pulling vessels by hauling on ropes laid at the bottom of the canal, he knew of an instance in which it had been found to answer very well indeed. This was in Hungary, where it was carried out by Mr. Murray Jackson, who had a very ingenious way of overcoming the difficulty which had been previously found in this system, namely, that in order to get a sufficient adhesion to the rope, it was nipped so tightly that the rope was soon destroyed. He overcame that difficulty by passing it over several grooved pulleys, six, eight, or even a dozen, having the pressure wheel at top forced down by springs. By this means he got sufficient grip upon the rope, without in the slightest degree damaging it.

Mr. Olrick said, every one who knew the labor involved in collecting such a mass of information would appreciate Mr. Harding's labors in writing the present paper, and, as an engineer he must say that the system described seemed far superior to any thing of the kind. It had this advantage, that it was not exposed, if properly protected, to those disadvantages that propellers often were when placed at the stern, of getting ropes and other matters entangled in them, nor would it have the effect of sending the wash of the water against the bank of the canal, and interfering with the foot path. It, however, appeared to him, that there ought to be, near the stern, a slight slope, so as to allow the water to get up more gradually; but that was a matter of detail, which would, no doubt, be altered by simple experience. As for comparing steam power with horse power, either with regard to economy or other advantages, it was not necessary to say a word, because it is so well known already. It was quite a mystery to him that proprietors of canal boats did not make use of the knowledge of engineers, who were only too willing to serve them, and to produce practical inventions for navigating canals much more quickly than at present. It was an undoubted fact, that many of the railways were so overloaded with goods transport, that most deplorable accidents happened in consequence, and if a system of quick and cheap canal navigation were arranged, he was quite sure it would have a beneficial effect on the railways. As an engineer, he must congratulate Mr. Harding on the scheme he had brought forward, and he hoped it would reap that commercial success which, after all, was the great test of merit.

Mr. Hamilton Towle said, Mr. Newton had described, in a very brief manner, a system of propelling boats with two wheels, but did not state whether they were at the bottom, the side, or the top. With regard to the invention described by Mr. Harding, it had many advantages. When a boat was heavily laden it squatted, and would drop on the bottom; but when Mr. Harding's invention was applied to it, the water being drawn in at the bow and drawn under, instead of allowing it to drop, raised it up, so that by that system the boat could carry a larger load in the same canal than any other. About a fortnight ago, when at Ostend, he met the engineer in charge of the whole of the canals through Belgium, who described to him a system about to be tried, at the expense of the man who proposed it. It consisted of a traction engine going along the bank, and drawing the canal boat by means of a rope. It appeared to him that this plan would never answer, inasmuch as the pull of the rope would tend to bring the engine and the rope together. In the case of the boat, that might be avoided by steerage, but he did not understand what was to prevent the engine being pulled overboard. If ropes along the bottom of the canal were used, it would be very awkward when two boats were pulling on the same rope, and wanted to pass in opposite directions. It would be something like two trains meeting on a single line of rails.

Willow Leaf Tea.

Mr. Medhurst, the British Consul at Shanghai, says "the preparation of the willow leaf for mixture with tea is openly openly practiced in the villages on the Hong-keu side of the Soo-chow Creek, and it has become an industry which claims an important share of the attention of the villages of that and other localities. The banks of the numerous creeks are planted with willow trees, the young leaves of which are collected in April and May, very much in the way that the tea leaf is gathered. The produce is then collected in heaps on the hard threshing floors of the hamlets, and is allowed to undergo a mild fermentation in the sun. The leaves are then manipulated, similarly to those of the ordinary tea plant. They are sorted into kinds, according to sizes, and afterwards roasted in common tea ovens. The appearance of the stuff, after this treatment, is not unlike that of the genuine article, and it is carried to Shanghai, and there intermixed with pure tea, at a ratio of from ten to twenty per cent. The cultivation and preparation of willow leaves were begun in Shanghai about ten years ago, and have increased year by year. The poorer classes near Shanghai have for a long period consumed this leaf as an infusion in place of tea, the latter being too expensive for them to purchase."

As far as he can gather, its use is productive of no ill effect, but its flavor has not the slightest resemblance to any known tea. The cost of the article cannot exceed 2d. per pound, but when mixed with tea, and so sold to foreigners, it must represent a very large profit to the producers.

He thinks the interference of the authorities with regard to this spurious manufacture, may shortly be necessary, for the purpose, if not of its actual prohibition (which may not be possible), at all events, of placing it under such control as that foreigners may be in a position to satisfy themselves as to the quantity produced, and the proportion used in mixing, so that the adulterated article may take its proper position in the tea market. From inquiries instituted through the superintendent of police, it transpires that there are at this moment about 400 piculs—say 53,000 pounds—of this willow leaf in the course of preparation at various drying houses in the foreign settlements at Shanghai. The probable amount made up last season is estimated at not less than 3,000 piculs, or 400,000 pounds. He is not aware that any analysis of the properties of the willow leaf has yet been made at Shanghai, but attention to the above facts will doubtless bring about an investigation of the kind, which is certainly demanded in the general interest, by the rapid expansion which is exhibiting itself in this feature of the tea trade.

EXPERIENCES OF A BUREAU OFFICER.

[Extract from a speech of Hon. S. S. Fisher, late Commissioner of Patents.

A gentleman called on me to solicit a place. I informed him that an examination would be necessary. He seemed in nowise disconcerted, but said he hoped it would be as easy as that which he had passed a few years before upon his appointment at the Treasury. He then proceeded to inform me that having applied for office there, he received a letter notifying him that, at a time to be thereafter designated, he might appear before a board of examiners, and, if found qualified, would receive his appointment.

A few days afterward, while awaiting the summons to the dreaded examination, he received another letter in these words:

SIR: Having been examined and found qualified, you are hereby appointed a second class clerk in the Treasury Department at a salary of $1,400.

I assured him that he would find our examination a very different affair. He accordingly sat down at a table in my room, and some simple questions were propounded. After studying on them for a time, he complained of headache, and asked permission to withdraw. The next morning he came again, and proposed to finish his examination. No objection was made, but new questions were substituted. As soon as he perceived that the interrogatories were not the same as those of the day before, he declined, with much dignity, to proceed, and abandoned the pursuit of the coveted position.

Another defect in the pass examination system was, that when it was merely a question of qualified or not qualified, it was impossible to satisfy the candidate or his friends that the test had been fairly applied, or that the result was to be accepted as a finality. Unsuccessful candidates were clamorous for a re-examination. Their Congressmen inspected the record and thought that the marks ought to be higher, and were always sure that no one else could have answered such questions any better than their *protegés*.

Great difficulty was experienced in giving the places to the best men, for every man who had technically passed the ordeal, although saved as by fire, was much offended if not appointed. Now as the number of candidates always exceeded the places to be filled, it seemed to be a pity to put men into the places who were just able to prove that they were not absolutely unfit, when it was nearly certain that a different system would disclose the fact that there were better men among the other applicants. In short, this method, while decreasing the number of applicants by a small percentage, left the greater number of candidates in the field, while the head of the department was still beset with all the weapons of influence, political services, fulsome flattery, and importunate persistence.

These considerations led me in June, 1869, having four vacancies in the corps of second assistant examiners, and having seventeen candidates for the places, to propose to the Secretary of the Interior to fill the positions by a competitive examination. He cordially approved of the plan, and the system of competitive examinations, thenceforth to be the rule of appointment in the Patent Office, was inaugurated. The candidates were summoned, and the announcement was made that, on a day named, a set of written questions would be propounded to them, which they would be expected to answer in writing. The answers were to be marked by impartial examiners, and the four whose marks were highest of the seventeen were to receive the appointment. Each man was seated at a separate table, and furnished with paper, pens, and ink. The questions were proposed in sets of ten each, and no one was allowed to leave the room until the set was answered. The candidates marked each sheet of paper by a private mark, letter, or word, and were not allowed to sign their names or otherwise to give any clue to their identity. They were instructed to write their real names and the private mark by which their exercises were signed upon a slip of paper, and to inclose it in a blank sealed envelope.

The answers were collected and laid before a committee, who were not acquainted with the candidates. Each question was read in turn, and then each answer was read and marked upon the margin—the lowest mark being 0, and the highest 100. When all the answers had been valued, the total marks of each candidate were added up and placed opposite the private mark by which alone he was thus far known. The highest four were designated for appointment, no one, not even the Commissioner, knowing who they were.

On the following day the candidates assembled in the Commissioner's room, and the averages were read in connection with the private marks only. Each man therefore knew his own marks without being able to say what were those of his competitors. The sealed envelopes were then opened in the presence of all, and the names of the successful parties were, for the first time, ascertained and published.

If there is a more impartial mode of examination than this, I have also to be informed of it. At every examination that was held, the candidates uniformly bore testimony to the entire fairness of the whole proceeding.

Of course, all preliminary questions as to moral character, political soundness, physical stamina, and the like were settled before the candidate was permitted to take part at all, and attention was also paid to the fair distribution of places among the unrepresented sections of the country. There were those who at once suggested that such examinations excluded men of years and practical experience, and opened the door of public office only to school boys. Men who wanted office, and who were full of years and empty of knowledge, were swift to urge this objection to a system which excluded them from the public service. But the facts do not sustain this objection. Tables were prepared founded upon the results of this examination, and of another held in the following winter for the same grade of assistants, in which twenty-four candidates participated. These tables show the following results:

FIRST EXAMINATION.

Number, 1; age, 22; born in Ohio; high school education; practical experience, 3½ years machinist; army or navy none; office service, 1 month.

Number, 2; age, 20; born in Virginia; collegiate education; practical experience, 2 years engineer; army or navy, 3 years; office service, 21 months.

Number, 3; age, 20; born in Maine; collegiate education; practical experience, 2 years cabinet maker; army or navy, none; office service, 2 months.

Number, 4; age, 28; born in West Virginia; academy education; practical experience, 8 years printer; army or navy, 2½ years; office service, 2 years.

SECOND EXAMINATION.

Number, 1; age, 40; born in Vermont; collegiate education; practical experience, 5 years; army or navy, none; office service, none.

Number, 2; age, 40; born in England; common school education; practical experience, none; army or navy, 2½ years; office service, 2½ years.

Number, 3; age, 37; born in Pennsylvania; collegiate education; practical experience, none; army or navy, 1 year; office service, 2 months.

Number, 4; age, 33; born in Connecticut; collegiate education; practical experience, leather manufacturing; army or navy, none; office service, none.

It will thus be seen that the young and the old, the practical and the theoretical, those in and those out of the office, were fairly represented. Nearly every one of the present corps of second assistant examiners has been appointed after passing through one of these competitive examinations, and I do not hesitate to say that so intelligent and efficient a body of men have never before been seen in the Patent Office. The system was at once applied to the clerkships and higher grades of examiners with the happiest results; and I do not think it extravagant to say that, if the same plan were in all adopted the departments, and rigidly and impartially adhered to, the number of employés might safely be reduced one third.

Every bureau officer knows that he must carry on his rolls some superannuated, some imbecile, some drunken, and some ignorant clerks, and as his work must be done, he must have more able bodied and able minded clerks to make up the deficiency. To reduce the number while the system of appointment and retention remains as it is, would in nowise relieve the bureau from the proportion of drones to working bees which swells the total beyond the number needed if all were first class men. The Patent Office could not have been run with less clerks than it employed, such as they were, but if some of them had been changed off for better men a less number could have been employed. As it was, we managed to run the Office during the year 1869 with a reduction of fifteen from the number which Congress had actually appropriated for, but it was found necessary to keep this fact a profound secret, as we well knew that if it were known Congressmen would be upon us in shoals, demanding that the vacancies should be filled by their friends (since the places had been provided by law), whether we wanted the men or not. I say Congressmen; by this, of course, I mean some Congressmen. There are men in both Houses who are as pure and public spirited as can be desired; men who will never ask for offices, or who, when they do ask, so put their requests that they assist rather than hinder a faithful executive officer; men who are heartily in sympathy with all suggestions looking to reform in the civil service, and who always stand ready to adopt such legislation as may be needful for that purpose. I wish that I could name them all. If I speak of Davis, Garfield, Coburn, Jenckes, Hoar, and Stevenson in the House, and of Trumbull, Schurz, Morrill, of Vermont, Wilson, and Patterson in the Senate, it is not because they stand alone, or are even more worthy of mention than some others, but because my own personal experience made me grateful for their zeal in the cause and their encouragement for the labor on its behalf which I was endeavoring to perform.

The system of competitive examinations offers the only fair mode of making selection among many candidates, and the candidates are always many. It was found to be so efficient in our office that upon the examination of the Census Bureau it was so far adopted as to confine appointments within the limits of certain averages, selecting first from the highest. As may be supposed, this did not please politicians. The theory which they desire to establish is beautifully illustrated in the recent case in the Toledo distr ct, where the removal of capable officers and the filling of their places with his own nominees was demanded as a perquisite of a member of Congress.

A gentleman called upon me and said he wanted a clerkship for a friend in his district. I replied, "I have already a man from your district."

"Who is he?"

"I don't know him. He is a young man, with a good war record, who has lately passed a competitive examination for a higher grade, having already occupied a lower position in the office, in which he has acquitted himself with great credit."

"Well, turn him out, he never did me any good."

"Why should I turn him out? He is faithful and able, a soldier, and a Republican."

"I tell you he never did me any good. I hope you mean to show us the usual courtesy of allowing us to select the nominees from our own districts."

In fact, I did not mean to do it, and in as polite language as I could command I told him so; and the result was that the Patent Office had no more determined foe on the floor of the House than this gentleman thenceforward became. I wish I were able to say that there were no more like him.

The Treatment of Mortar.

Much of the mortar used in buildings is unfit for the purpose, and much of that which is good is prepared by the workman mechanically, according to a given recipe, and not because he understands the reasons which make certain proportions of sand and lime endure better than others. The following practical lines by Mr. A. C. Smeaton, the author of a valuable work on building, not only afford instruction regarding the preparation of mortar, but give the reasons why it should be treated in the manner described:

"When mortar is to be used in a situation where it will dry quickly, it should be made with as little water as possible; but it is better that the mortar should dry gradually and slowly, as it then becomes more indurated. It is stated by some writers that mortar is injured by keeping, and under one condition, exposure to the air, it is; but if excluded from the air, it is rather benefited than injured. Pliny states that the Roman builders were prohibited by law from using a mortar that was less than three years old; and attributes the stability of all their large buildings to this circumstance. But when old mortar is used, it should be well beaten up before it is employed. The reader must not, however, suppose that these remarks justify the exposure of mortar to the air for a considerable time before it is used, a practice very common, but highly improper. The practice probably arose from the difficulty which workmen sometimes find in slaking the lime, in consequence of its being insufficiently burnt, or containing a large portion of argillaceous matter. But of all other things, it is important to use good lime, and to soak the bricks which are to be bedded before they are laid; for if the bricks are dry, they imbibe the moisture of the cement, and destroy its quality. There are two things which cause mortar and cements generally to crack—too small a quantity of sand, and too rapid exhalation of the water. There must always be a contraction; but it is least in those mortars which contain the greatest proportion of sand; for it is the moistened lime which contracts during the process of drying. All mortars may, for a time, be affected by atmospheric changes, and especially by alternate wetting and freezing, but this is most remarkable in those which are liable to crack. A mortar which sets without cracking will always stand afterward."

What the Microscope Reveals--With a Moral.

Lewenboeck tells us of an insect seen with the microscope, of which twenty-seven millions would only equal a mite.

Insects of various kinds may be seen in the cavities of a grain of sand.

Mold is a forest of beautiful trees, with the branches, leaves, and fruit.

Butterflies are fully feathered.

Hairs are hollow tubes.

The surface of our bodies is covered with scales like a fish; a single grain of sand would cover one hundred and fifty of these scales, and yet a scale covers five hundred pores. Through these narrow openings the sweat forces itself like water through a sieve.

The mites make five hundred steps a second.

Each drop of stagnant water contains a world of animated beings, swimming with as much liberty as whales in the sea.

Each leaf has a colony of insects grazing on it, like cows on a meadow.

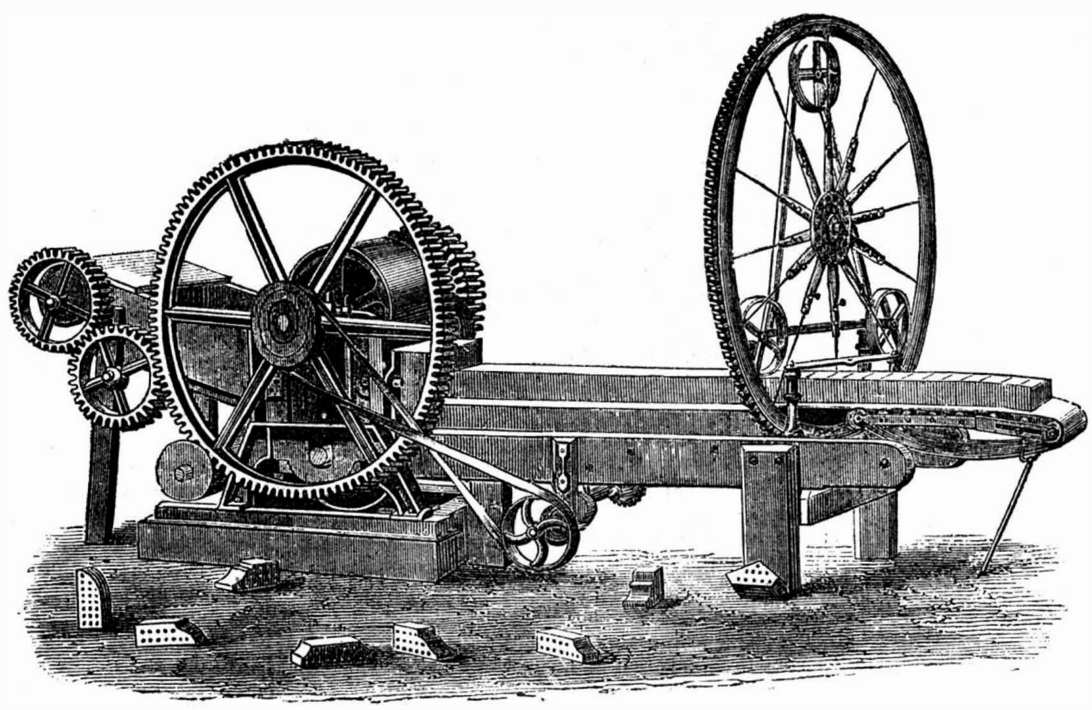
Moral.—Have some care as to the air you breathe, the food you eat, and the water you drink.—*Home and Health.*

Medical Microscopy.

It is difficult, says the *American Journal of Microscopy*, to imagine how any physician can practice with satisfaction to himself and for the good of his patients, without the aid of the microscope. In all the recent text books relating to pathological anatomy, diagnosis, and other departments of medicine, constant allusion is made to the developments of the microscope in throwing light on the essential nature of disease. We hold that the physician who ignores microscopic analysis and investigation is not fit to treat obscure and complicated disease. As an illustration of this a case came under the care of the writer—of a gentleman who for years had suffered intensely from dyspeptic symptoms accompanied by great mental depression—so peculiar as to deprive him of nearly all social enjoyment, or business energy. He had been treated by many physicians but got no relief. His urine had never been analyzed. Upon placing a portion of the sediment, prepared according to Dr. Bird's directions, under a moderate power, the specimen showed the presence of a large quantity of the crystals of oxalate of lime. The diagnosis was now clear enough, and the treatment plainly indicated. A complete recovery followed in a few weeks.

Self-acting Brick Machine.

Among the exhibits in the Pottery Machine Annexe, at the International Exhibition, in London, is a self-acting brick, architectural mold, and drain pipe machine, invented by Mr. J. D. Pinfold, of the Warwickshire works, Rugby. Its appearance and construction are at once striking and ingenious; it consists of a strong iron frame, one end of which carries the mixing apparatus or pug mill, which is nearly horizontal, and is seen to the left in our engraving. The clay is fed into this mixer, in which are two parallel shafts armed with a series of cutters, and revolving in opposite directions. On the shafts at intervals are fixed a set of scrapers, which clear the sides of the mill of the clay and keep it well under the control of the knives. The clay is thoroughly amalgamated by the action of the blades, and is, at the same time, carried forward to a pair of rollers, one above and one below, placed a quarter of an inch apart. A pair of cheeks, one at each side of the rollers, serve to guide the clay between the rollers. By an ingenious arrangement, the clay is lubricated while passing through the rollers, the water being conveyed to it through the cheeks, which communicate by a tubing with a small cistern overhead. From the rollers the clay is delivered into a compressing chamber, and thence to the mold, from whence it is seen in our engraving issuing in a continuous stream on to an endless traveling band carried over two rollers. The mold chamber is fitted with a lubricating apparatus, the water issuing from the sides and corners of the mold near its mouth in a very thin film. By this means the clay is lubricated as it leaves the machine, which gives it a smooth glossy surface.



PINFOLD'S SELF-ACTING BRICK MACHINE.

The stream of molded clay having reached the end of the traveling band, it passes under the operation of the cutting wheel. This part of the apparatus is carried by a triangular-shaped framing, at each of the angles of which is a friction pulley gearing into the inner rim of the cutting wheel, and serving to keep it in a proper position. The cutting wheel is driven by a pinion on a shaft under the machine and which gears into teeth formed on the periphery of the wheel itself. This wheel has a central bearing in a portion of the triangular framing, and it carries a number of wires arranged as spokes. There is, however, no weight brought on this central bearing, which merely holds the cutting wires in tension. As the stream of clay passes through this wheel, it is cut up into fine square bricks which are carried on a traveling delivery, to the end of the machine. If the cutting wheel were set at right angles to the direction of the clay the latter would be cut diagonally. The wheel, is, therefore, set at a slight angle to the stream of clay, and consequently a perfectly right-angled cut is made. The machine is 18 feet in length, 5 feet in width, and 6 feet in hight over all. It will be seen that it is self-acting throughout, and by adjusting the mold and using cone bars it will make perforated bricks, coping, cornices, etc. The bricks are sufficiently stiff to be removed at once from the machine and walled six or eight high.

On the Physical Sciences which form the Basis of Technology.

Putting aside all questions of beauty, morality, or philosophy, we are to consider where man can acquire the knowledge which will give his body the victory in the daily battle of life. The problem which he has to solve is a vast one; so vast, indeed, that instead of attempting to enumerate the items which make it up, I will say in one word, that his capital to begin with is one wise head and ten skilful fingers, and that with these he must build such a Crystal Palace as the world saw in 1851, and stock it with all its wondrous contents. To solve this problem he must fall back upon the sciences which reveal the properties of matter, and the modes of altering it.

The sciences in question are familiarly divided into natural history, on the one hand, and experimental physics, including chemistry, on the other. Natural history, on this view, is the science of all these objects, phenomena and laws, which physical nature spontaneously presents to our view; while experimental physics is the science of all the additional objects, phenomena and laws, which our interference with nature enables us to bring under our scrutiny.

Such a twofold division, however, is not sufficient for us. All the sciences observe and register the phenomena and laws which nature presents within the circle alloted to each; and are therefore portions of natural history, or naturalistic. All the sciences, also, but astronomy, experiment upon, or subject to trial, the objects presented by nature to each; and are therefore experimental. The difference, accordingly, between the majority of the sciences which are observational, and those which are experimental, is only one of degree. A distinction of a much deeper kind lies in the fact, that the experiments which the one characteristically makes, are simply more precise observations of what nature presents; while those which the other characteristically makes, imply the transformation or transmutation of natural objects, and the study thereafter of the results of such transformations.

In addition, however, there is a third class of experiments, neither simply observational nor transformational, but registrative and directive, in modes which I shall presently consider. And, further, biology, the science of plant life and animal life, must have a place to itself, from the peculiarity of the subject matter with which it deals.

I would arrange the physical sciences, accordingly, as related to Technology, in three groups.

I. Naturalistic, observational, and registrative sciences, of which the chief are astronomy and geology, including meteorology, hydrology, physical geography, mineralogy, as well as descriptive botany and zoölogy.

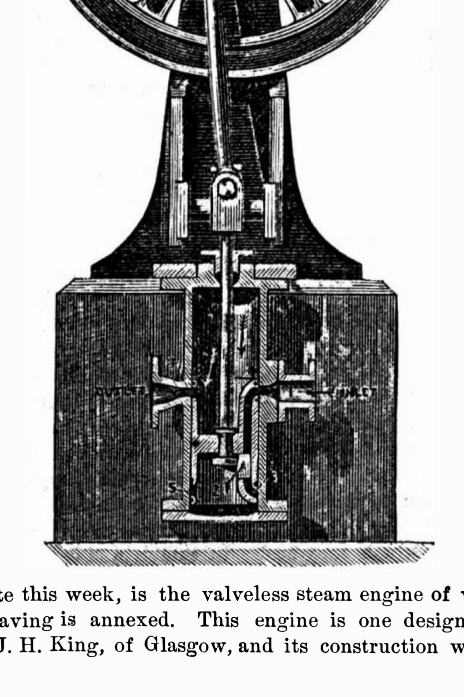
II. Experimental, transformational, and directive sciences of which the chief are chemistry and mechanics, as well as heat, optics, electricity and magnetism.

III. Organic sciences: namely, functional or physiological botany, which treats of the plant life of non-sentiment organisms; and functional or physiological zoölogy, which treats of the animal life of sentient organisms.

This complex, nominally triple arrangement, is essentially twofold, in its relation to Technology. The industrialist must study one class of the physical sciences, or rather one side of all the physical science, to consider what gifts nature offers him with her liberal hand. He must study another class of these sciences, or rather another side of all physical science, to discover how to turn those gifts to account. There is always, on the one hand, something to be had for the taking, a raw material, a physical phenomenon, a physical force. There is always a necessity, on the other hand, for expenditure of skill to effect the transformation of the raw material, the registration of the phenomenon, the direction of the force.

KING'S "VALVELESS" ENGINE.

Among the exhibits at a recent *Conversazione* of the Institution of Civil Engineers, London, which we are enabled to illustrate this week, is the valveless steam engine of which an engraving is annexed. This engine is one designed by Mr. H. J. H. King, of Glasgow, and its construction will be readily understood from the annexed section. The piston, it will be noticed, is made very deep, and has four ports formed in it, two on each side. Of the two upper ports, one communicates with the cylinder above the piston, while the other forms the mouth of a passage leading to the under side of the piston, as shown. In the same way, of the two lower ports, one leads to the lower end of the cylinder direct, while the other communicates with a passage leading to the upper side of the piston. The cylinder, also, has two ports formed in it opposite each other at the middle of its length, one of these being the inlet and the other the outlet port.



Supposing the piston to be at the bottom of its stroke, in the position shown in the section, the section will be as follows: The steam enters by the inlet pipe, 1, and passes down the passage cast in the piston, filling the cavity, 2, in the latter, and the clearance at the bottom of the cylinder. This admission of steam causes the piston to rise, when, with the proportions shown the steam will be cut off at about one eighth of the stroke, the steam then expanding until at about thirteen sixteenths of the stroke, the bottom port, 5, in the piston, begins to open to the outlet pipe, and the exhaust commences. A little later, at about seven eighths of the stroke, the lower piston port, 3, begins to open to the inlet pipe, and steam is thus admitted to the upper end of the cylinder, causing the piston to perform its downward stroke. The exhaust ports are made sufficiently large to reduce the steam pressure in the cylinder to very little above that of the atmosphere before they close, the remaining steam being then compressed, and assisting to fill the clearance spaces.

In making high-pressure engines on this plan, to run with a piston speed of 200 feet per minute, or upwards, Messrs. King & Co. make the width of the steam ports equal to about one eighth, and that of the exhaust ports equal to about three sixteenths of the stroke; but, owing to the variation of piston speed, at different parts of the stroke, produced by the crank motion, each steam port will be open for about 44 per cent, and each exhaust port for about 52 per cent of the time occupied by each revolution

It may, says *Engineering*, whose description we have copied, at first sight, appear that an engine constructed on the plan above described must necessarily be a very wasteful steam user; but a little consideration will show that this need not be the case, particularly if the cylinder be steam jacketed. Its good performance will, however, depend greatly upon the capacity of the clearance spaces and the point of closure of the exhaust being properly adapted to each other, and to the pressure of steam with which the engine is to be worked. Speaking roughly, the most economical performance, as far as the consumption of steam is concerned, will be obtained when the ratio of compression is such that if no steam were to enter through the supply port, the steam enclosed in that cylinder would attain the boiler pressure at the termination of the stroke. In this case, the steam used per stroke would equal that required to fill a length of the cylinder equal to the width of the supply port, and the work done per stroke would be approximately the same as that which would be developed by the same quantity of steam used in a cylinder without clearance, and expanded the same number of times as in Messrs. King's engine. The principal effect of the early closure of the exhaust port, during the exhaust stroke which takes place in this engine, is to reduce the power which it is possible to develop in a cylinder of given size. The greater part of the power expended in compressing the steam during the exhaust stroke, is given out again during the steam stroke, the precise proportion between the power absorbed and that regained depending, as has been explained on former occasions, upon the relative ratios of compression and of expansion, during the exhaust and steam strokes.

It is stated that the non-condensing engines, constructed on the plans shown in our engraving, are found to compare favorably, as regards economy, with ordinary non-condensing engines having single slides cutting off at about five eighths or three fourths of the stroke, a class of engine of which so many are now made for various purposes; while they have the advantage, as compared with these engines, of having no slide valve, eccentric, valve spindle, or valve spindle stuffing box, and they are, moreover, capable of running in either direction. When applied to steam cranes, therefore, small pipes with cocks for admitting steam to either the top or bottom of the cylinder for starting, replace the ordinary link motion with a very considerable saving of cost.

It is also claimed that the arrangement will give better comparative results with condensing than with non-condensing engines. In large engines, means are provided for varying the amount of clearance at will, and the ports, instead of being cut completely through the cylinder, consist of a number of small holes, over which the piston rings pass easily.

TO WASH FLANNEL.—Never rub soap upon it. Make a suds by dissolving the soap in warm water. Rinse in warm water; very cold or hot water will shrink flannel. Shake them out several minutes before hanging to dry. Blankets can be washed in the same way.

Care of Machinery---Safety of Workmen.

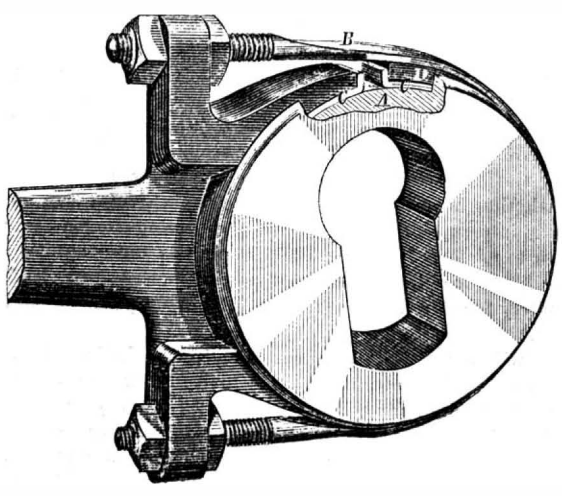
"Where is your engineer?" we inquired recently of some workmen as we stood by a thumping engine and a dirty boiler with two rusty gage cocks. "Oh! the boy you mean; he is playing around somewhere," was the answer. Leaving the youth to enjoy his frolic, we examined the machinery that had been consigned to his charge and watchful care. On finding that water issued from the top gage cock, we felt easier. We then looked for a steam gage, and lo! far back on the top of the boiler, we descried a dingy looking dial upon which with our best eye glasses, we failed to discern any indicating pointer or figures. We then explored for the safety valve, and found it safely covered with an accumulation of coal and sawdust, and out of the reach of both anxious inquirers and boys. But here comes the boy engineer. The fire doors are flung open, all the fuel that can be stowed away is thrown into the furnace, bang go the doors again, and he is off to finish his game. We subsequently learned that there were three rented workshops with machinery driven from this engine and boiler, and that the latter was second hand when it was put on the premises. A short distance from these works, we found another boy engineer in charge, and the machinery gradually wasting away from hard knocks, cold neglect and old age. "Why does not your landlord employ a competent and careful engineer who would keep his machinery in repair?" we again asked, and smilingly added, "You would feel safer if he did." "Oh, he says he cannot afford it," was the answer. Here, then, were second hand boilers, boy engineers, machinery out of repair—all tolerated on the plea of want of means. It is no wonder that the workmen in those buildings scold the boys, but despise the landlords who cause their lives to be put in jeopardy ten hours every day. These are not "fancy sketches," but the state of things as they actually exist in the instances described; and we too frequently find the same condition of things in all parts of the country. The condition of machinery in many of our manufactories is disgraceful, not to say dangerous. We write this from no hearsay; we know it from daily personal observation. Owners of machinery, in nine cases out of ten, pay high prices for their "power;" but when they have got their machinery in running order, they seldom employ a competent engineer, but get some raw hand or "smart boy" who thinks he can "fire and run an engine." They claim that neither their profits nor their business will allow them to pay high wages for running their machinery; but after a few accidents, for which they have to pay handsomely, they learn the economy of keeping their mechanism in repair, and employing reliable and competent persons to run their engines. We maintain that it is as much a duty of a manufacturer to examine or to have examined daily the state of his machinery, from boiler to journal, as it is to inspect and examine his wares. Are not lives as valuable as property? Is not the health of an employé of as much consequence as a bale of goods? And yet we see dirty and greasy floors in the engine room; the examination of the safety valve often requires the use of a lamp; pipes leak steam and water; bearings are without drip pans; belts are without guards, and occasionally send a patient to the hospital; steam pipes are rusty for want of paint; rooms are hot and poorly ventilated; the machinery is crowded; the passages are narrow; windows are unwashed; light is limited; grease and dirt are plentiful, and noise from unrepaired machinery adds to the general discomfort. We charge the whole of such neglect and carelessness on proprietors, because if they would employ intelligent and com petent assistants who understood their business, and took a pride in the care and appearance of machinery, there would be a vast difference in the general neatness and good appearance of the works. In addition to this, a salutary influence would soon be observed in the health, conduct, and feelings of the employés. We could enlarge upon the advantages which would result from manufacturers enforcing thorough cleanliness, constant watchfulness, frequent examination, and immediate reports of all and everything that gets to be dangerous about their machinery, or that requires repair; but the good results accruing from such regulations are apparent to every mind. We close by simply remarking that, in instances where investigation, thorough and complete takes place, and where machinery receives the attention it demands, there we notice an amount of satisfaction and honorable pride on the part of both employer and employés.—*Technologist.*

The Poisonous Qualities of Chromate of Potash.

A professor of the University of Charkow recently fell a victim to poisoning by neutral chromate of potash. M. Neese complains that up to the present time the poisonous qualities of the chromates are not perfectly understood, and proposes as an antidote the acetate of lead. Neese himself acknowledges, however, that the antidote may produce worse results than the poison itself, and requests toxicologists to point out an effectual remedy. The ignorance in regard to the poisonous qualities of this substance is, however, not so great as M. Neese supposes, for already in 1853 Jaillard, in the *Gazette des Hôpitaux,* called attention to the danger in using it. The physician must be very careful in the employment of bichromate of potash; a dose of 0·25 gramme was sufficient to kill medium sized dogs in from two to six days. Jaillard himself took 0·12 gramme, and observed with small doses dangerous symptoms. Most of the organic substances, particularly the hydrates of carbon, such as sugar, alcohol, and the organic acids, decompose the chromic acid into oxide of chromium; this is particularly the case with tartaric acid, which Frederking has proposed as an antidote against poisoning with chromic acid. The decomposition of tartaric acid, unless it is very much diluted, takes place in about one and a half minutes, chromate of potash and carbonic acid being formed. It will still be necessary to try this antidote on living beings.—*Photographische Zeitung.*

FOWLER'S IMPROVED METHOD OF ADJUSTING ECCENTRICS.

The object of this improvement is to obviate rattle or jar in the working of eccentrics, wherever used on steam engines, rub rolls, comb drivers, or any other machinery; and also, whenever the parts wear loose, to enable the wear to be taken up by means of the screws and nuts at the end of the strap. The method of accomplishing this is shown in the accompanying engraving.



The eccentric strap, B, extends from two lugs formed on the connecting rod about the eccentric, A, as shown, the ends of the strap passing through the lugs and being threaded to receive the tightening nuts.

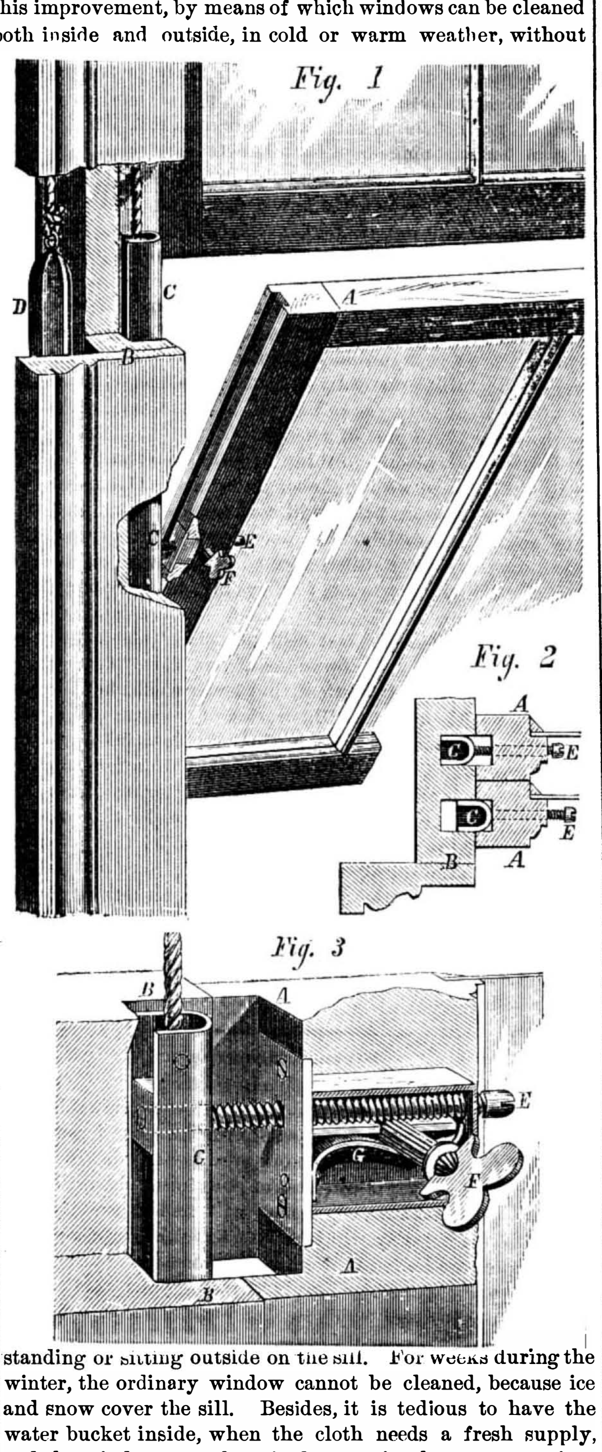
C is a wearing plate which underlies the eccentric strap on the half circumference opposite the eccentric rod.

Between the eccentric strap, B, and the wearing plate, C, may be placed a pad of leather or other suitable material, if desired, which adds to the delicacy of adjustment, and aids in accomplishing the ends sought.

Patented June 1, 1869. For machines or rights address Geo. Fowler, patentee, Philmont, N. Y.

NELSON'S REVERSIBLE WINDOW SASH.

Every housekeeper will appreciate the want supplied by this improvement, by means of which windows can be cleaned both inside and outside, in cold or warm weather, without



standing or sitting outside on the sill. For weeks during the winter, the ordinary window cannot be cleaned, because ice and snow cover the sill. Besides, it is tedious to have the water bucket inside, when the cloth needs a fresh supply, and the window must be raised to get in the room to rinse and replenish, proving an annoyance and source of constant slopping on carpet and wall paper.

In the arrangement illustrated, the sash can be turned completely over, washed from the inside of the room and turned back when done, so that no danger is incurred, and no draft created.

The frame, B, Fig. 1, and the sashes, A, are grooved to receive a guiding bar, C. This bar is of metal, rolled into gutter or U form, which makes it light and strong, and leaves a groove for the weight cord, which is fastened near the center by knotting, and slipping into a casting, shown in Fig. 2, as in ordinary wooden sashes. When the window is in customary position, the guide is partly in the sash, and partly in the frame, sliding up and down with the sash, and completely stopping any draft.

Fig. 2 exhibits a portion of the sash, part of the pivot casing being cut away. This shows the pivot, E, passing through the sash, and screwed into the guide, C. Inserting the key, F, which fits screw threads formed on E, the guide is thrown entirely out of the sash and into the frame by turning the key, leaving the window free to turn over. When turned over, the key is again inserted on the other side (the keyhole passing through the sash), the guide drawn back again, and the window is held steady, leaving both hands free to handle cloth and bucket. A spring, G, fits into the screw threads, and holds it wherever left, making it at all times perfectly secure. When the key is inserted, it throws the spring out of action, allowing the pivot to move back and forth. But one key is necessary for the whole house. The upper sash being fitted in the same manner, by throwing all the guides out at once the sashes readily pass each other, and no draft is created, and no extra fire needed on cold days when cleaning.

The guides can be used either with or without weights, D, and with sashes containing one, two, or more lights, as shown in the engraving. Old windows can be fitted by grooving the sash and frame. The window thus made costs but a trifle more than the ordinary frame, as no stops or beads are used, the guides acting as draft obstructors; and the strength of the sash is undiminished, the groove being but one fourth of an inch deep by five eighths of an inch wide, and the pivot three eighths of an inch in diameter, the head coming just inside the glass; while the saving in health fuel, time consumed in cleaning, etc., would, especially in hotels, etc, repay ten times the cost. To take the sash out it is only necessary to unscrew the pivots, E. To replace a pane, however, or to paint the sash, it can be turned over as when cleaning.

Patented June 6, 1871. For further information, rights to manu acture, State rights, etc., call on or address the inventor and patentee, W. P. Nelson, 618 N. Main street, St. Louis, Mo.

Correspondence.

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

Mechanical Equivalent of Zinc.

To the Editor of the Scientific American:

As I have now my hand in it, I may as well go on and answer Mr. Paine's arguments found under the above head on page 36. I hope Mr. Paine will return the compliment and also answer my arguments found on the same page, so as to keep up a cross fire for the instruction and amusement of the readers of the SCIENTIFIC AMERICAN, and for the edification of "the gentlemen associated with him," the stockholders in the new electric company, the ups and downs being the only thing needed now, as it is bound to be the *finale* of the whole affair.

However, as Mr. Paine has come down from the absurd assertion of 67,000,000 foot pounds from 3 grains of zinc, made before, to the more reasonable claim 23,000,000 foot pounds from 33 ounces of zinc, I will not ridicule it this time, but consider it seriously, scientifically, and practically, for the instruction of all concerned.

The theoretical mechanical equivalent of zinc depends, as does that of all other combustible substances, chiefly on the amount of oxygen it is able to consume in oxidizing. The oxygen is here, as well as in any fuel engine, or in any animal power, the great motion-giving, or life-giving agent; and when we say that one pound of coal has the capacity to produce 14,000 units of heat, it is on the condition that this coal shall combine with two and two thirds lbs. of oxygen. Therefore, we may just as well say that the consumption of two and two thirds lbs. of oxygen with the proper amount of coal, produces the 14,000 units of heat; a view for which there is fully as much ground as for the ordinary statement, and which is besides sustained by the fact that the amount of heat produced, if not exactly proportioned to the amount of oxygen consumed, depends much more on this amount than on the amount of the combustible. So we find that the amounts of heat developed by the combustion of equal parts of zinc, sulphur, carbon, and hydrogen, are equal, respectively, in ratio, to the numbers 1, 4, 16, and 64, while the amounts of oxygen consumed, during combustion of equal parts, is respectively 1, 4, 10, and 32. Therefore, in place of saying that the potential heat is stored up in the combustible, we may as well maintain that it is stored up in the oxygen or its equivalent, the supporter of combustion (chlorine, bromine vapor, sulphur vapor, etc). This is a view which for many years I have defended in my lectures, and which I have only abandoned recently for the better information now in our possession, by the discovery of the latent heat of dissociation, which is the true origin of the heat developed during combustion, and which has cleared away the mystery which thus far always surrounded the phenomena of combustion and flame.

Heat being nothing but a mode of molecular motion (see Tyndall), and always directly convertible into motion of the mass, every unit of heat being equivalent to 772 foot pounds, we may directly calculate the mechanical equivalent of any substance from which we may develop heat. Electricity is nothing but another mode of molecular motion; this is a theory of which there is a direct proof, and which is, therefore, even better established than the heat motion theory.

There is no room here to go into the details proving this, and disproving totally and flatly the existence of the caloric and electric fluid. The difference between the two is that when we oxidize zinc in the air, we obtain heat motion; when we oxidize it in a liquid, we obtain electric motion, both molecular, and both convertible into motion of the masses, which is the so-called force or power. And even as we may collect and utilize the heat more or less perfectly in furnaces of different construction, so we may collect and utilize the electricity more or less perfectly in galvanic batteries of different construction; and the amount of latent force thus obtained may differ in both cases, depending as it does on circumstances. Therefore, the argument of Mr. Paine that "a Daniell battery uses 75 pounds zinc, and a Grove only 50 pounds, to do the same duty," proves as little in regard to the accepted theory, as the well known fact that a tubular steam boiler evaporates 5 pounds of water for every pound of coal, while a Cornish boiler evaporates ten pounds of water for the same combustion; in fact, there is in this respect as much variety in steam boilers as there is in galvanic batteries.

As now, during oxidation of the zinc, one pound of this metal combines with four ounces oxygen, while 1 pound of coal combines with 2⅔ pounds oxygen, and as the molecular motion or potential force developed—whether of a caloric or electric nature—is ten times greater in using coal than in using an equal amount of zinc, the mechanical equivalent of zinc has been established to be 772 × 1,400 or 1,080,800, while that of coal is 772 × 14,000 or 10,808,000 foot pounds.

The great error of Mr. Paine is that he overrates the zinc equivalent, believing, as he does, that "the world knows nothing about the mechanical equivalent of zinc under combustion in a battery." To this I answer that *that* portion of the world consisting of the hard working investigators, who, without prejudice, and with indefatigable energy, search for the truth and nothing but the truth, know more about this subject than Mr. Paine, by his own showing, proves to be aware of. I will attempt to give him a slight insight into the matter, first by explaining the discrepancies in the statements of equivalents, and then by mentioning some important facts discovered.

Firstly, the differences in the statements of the mechanical equivalents of zinc, are, as mentioned before, not greater than those of coal in the steam engine. Theoretically, 1 pound coal must produce in round numbers 10,000,000 foot pounds, which, when consumed in one hour, corresponds with nearly 5 horse power, while in practice the best engines seldom have succeeded in reaching one tenth of this, or 2 pounds of coal per hour for 1 horse power, while others give only one twentieth of the theoretical power, using 4 pounds of coal, and even more, per horse power. As the theoretical mechanical equivalent of zinc is in round numbers 1,000,000 foot pounds per pound of zinc, we have here—assuming that the electromagnetic motors are, on the average, as good as the modern steam engines—a range from 1,000,000 to 100,000 and 90,000 foot pounds, and even less per pound of zinc.

The complex statement at the head of the article on page 36, that 22 lbs. zinc gave 2 horse power for 9 hours, properly reduced to foot pounds for comparison, gives $\frac{33000\times2\times9\times60}{22}$ or 1,620,000 foot pounds per pound of zinc; it is too large. Page's estimate of 3 pounds of zinc per horse power gives $\frac{33000\times60}{3}$, or 660,000 foot pounds per pound of zinc; it is too small, being made up in the supposition that not much over one half of the theoretical power is obtained, while Liebig's 64 pounds corresponding with $\frac{33000\times60}{64}$=30,937 foot pounds per pound of zinc, is based on the observation, that electromagnetic motors are not quite as good as the steam engines, in regard to the utilization of fuel, as they only utilize about $\frac{1}{30}$th of the theoretical amount, which is only one half or one third of the capacity of the ordinary steam engine. And I must confess that as far as my measurements of practical results, obtained by the many electromagnetic motors which I have tested, have gone, the estimate of Liebig is the nearest to the truth. However, I do not deny, that when those who have made the study of electromagnetism a specialty, and are well posted in regard to the extensive labors of the French, and especially of the German investigators, apply special improvements in diverse details, these results may be surpassed, and even electromagnetic engines made which utilize more of the existing power than the steam engine does; but even if one does succeed in making a machine which utilizes the full theoretical amount of 1,000,000 foot pounds per pound of zinc, it will only be $\frac{1000000}{33000\times60}$, or nearly ½ horse power per pound of zinc, which, with the required oxidizing acids, will cost about one hundred times the equivalent amount of coal, combining with the oxygen of the air, which costs nothing.

But the principal feature of the task I have taken here upon myself, is to consider Mr. Paine's *experimentum crucis.* He takes 120 electromagnets, each of which may lift 50 pounds one tenth of an inch high; and then assumes that he may pass, in a single second, by means of a proper commutator connected with the coils, the same current successively through all these magnets, so as to obtain, in a second, 120 times the raising of 50 pounds through the space of one tenth of an inch each. This would give $\frac{120\times50\times\frac{1}{10}\times60}{12}$, or 3,000 foot pounds per minute, or nearly one eleventh part of a horse power. Then he proceeds to state the consumption of zinc required to perform this labor, and says that "four eight inch zincs, under the resistance of 1,100 feet, No. 14 wire (that of the coils) will, in 12 hours, lose 3 ounces in weight." This is 2 grains per minute, or, in other words, 33 ounces per horse power for 12 hours. Reduced to my uniform standard it is $\frac{12\times60\times33000\times16}{33}$, or 11,520,000 foot pounds per pound of zinc. It is seen that he obtains thus a mechanical equivalent over ten times that of coal, while, in fact, he should obtain it ten times smaller, a difference of one hundred times. If his reasoning were correct, the expense of coal and zinc to obtain motive power would be equal.

It is easy to see the cause of this error; he starts from the assumption that the consumption of zinc in the battery is the same whether he passes the current quietly through 1,100 feet No. 14 wire, giving it no other labor to perform but to raise the temperature of the wire by an uninterrupted current, or whether he passes it in one second, through 120 such wires, interrupting it 120 times, and giving it mechanical labor to perform in lifting 120×50 pounds one tenth of an inch high, or obtaining 600 foot pounds per second. Unfortunately for Mr. Paine's theory, this assumption is totally false.

He will know that when currents run in helices around electromagnets, that then, at every break, at every change of the current from one coil to another, nay, at every fluctuation or variation produced in the discharge by varying contact or other causes, induced or secondary currents are produced which re-act on the battery, and tell, most strikingly, their effects in the enormous increase in the consumption of the zinc. This, by the way, is the reason why the use of a Rhumkorf coil wears any battery out so very rapidly. Then there is another fact. According to experiments of Du Moncel, the maximum distance of magnetic attraction of the iron of electromagnets diminishes when constantly used; it wears out, or the amount of attraction under equal circumstances becomes unmistakably smaller under successive charges.

But the main point to which I wish to call special attention, and which overthrows Mr. Paine's whole reasoning, is the discovery of Feilitch, made many years ago, but of which Mr. Paine appears to be totally ignorant. It is this: *As soon as an electromagnet is made to exert attractions and re ulsions, then immediately a proportional increase of the currents takes place, and a consequent proportional increase in the consumption of the zinc.* If it were practically possible to make the arrangement of the 120 electromagnets charged successively in one second, the consumption of the zinc would rise, from three ounces in twelve hours, to thirty, forty, or fifty ounces; and I wonder that Mr. Paine, if he be a conscientious experimentor, has not found this out before, as I did.

If such a reasoning about 120 magnets be correct, why not say 2,000,000? And you have $\frac{2000000\times50\times\frac{1}{10}\times60}{12}$, or 50,000,000 foot pounds per minute for two grains of zinc; this beats even the highest assertion Mr. Paine indulged in on page 404 of the last volume.

I hope Mr. Paine is also aware that there exists such a thing as resistance in the iron. To acquire and lose magnetism it takes a certain time, however short, and therefore it is very doubtful if practically even the number of 120 magnets could be arranged so as to have all in succession magnetized, each in the 120th part of a second.

It is *a priori* absurd to think that the consumption of zinc will not increase with the labor performed. One may as well expect that a steam boiler will consume no more fuel when the engine has to drive the machinery of a whole factory than it will when it is disconnected by throwing off the belts, and the engine runs alone, having only to overcome its own resistance.

Finally, Mr. Paine's last sentence, that "the battery cost has nothing to do with the success," and that "if electric currents were absolutely costless, they never would be more than a large toy," is a curious illustration of the turn of his mind. He ought to consider that the final and crucial question of any enterprise is: *Does it pay?* and that, therefore, the great battery cost is *the* sole question in the matter, and has always been the fatal rock on which all attempts in this direction have been shipwrecked. He ought to consider that, supposing we succeeded in storing up electricity from the clouds, like we do the rain water from the same source, either naturally or artificially, we might have absolutely costless electric currents, which would, as well as the costless water power so universally utilized, be more than a large toy.

New York city. P. H. VANDER WEYDE, M.D.

Flying Machine.

To the Editor of the Scientific American:

I have now been a constant reader of your valuable scientific paper for the last ten years, and the more I read it the more I am convinced that no one who has any desire of keeping up with the rapid progress of the times, should be without it. The inventor, especially, will find it greatly to his interest, for not only will he obtain a multitude of new ideas, but moreover he will often save himself a great deal of trouble and expense, by simply perusing your valuable comments on principles which time and the experience of many have proved to be unalterable.

Moreover, one may, now and then, experience a novel and very striking sensation, through your columns, by finding that somebody has been experimenting on some cherished hobby of his own. Such has been my luck, in perusing your number of June 24th, for great was my astonishment at finding a full and complete description of an invention which I considered mine, and for which I obtained a *caveat* some few years past. I then applied the device to balloons for the purpose of elevating and lowering them without any use of ballast or loss of gas.

My experiments succeeded beyond my expectations, for not only could I elevate and lower my balloon by these means but moreover, I was enabled to draw it some 35° from its natural course.

Noticing the great power which could be exerted on the air by means of this contrivance, I applied the same principle to a self air propeller, and in the fall of 1866, I constructed a small model in every respect similar to the one described on page 407, last volume.

I did not, at the time, push my idea any further, for the want of a suitable motive power, in reference to which I wrote to you, inquiring whether gun cotton or nitro-glycerin done up in small cartridges, could be used for the purpose if exploded in suitable cylinders. Your answer, which I now have before me, was in the affirmative, but not daring to experiment with such terrible explosives, I let the subject drop until about a year ago, when I got up full drawings of my apparatus, and showed it to several engineers of New Orleans, who expressed the firm belief that with some suitable motive power it might be made to work.

However, my air propeller remained *in statu quo* until some six months ago, when some of those kind individuals with whom inventors often meet, relieved me of my drawing; and now, through your valuable columns, I am informed that some one has been kind enough to get me up, at his own expense, "and without the least trouble to myself," a full size working model, and that it is now hanging in the old Novelty Works, New York, awaiting some one to claim it. I am sorry for those worthy projectors that they could not make it go, but I am pleased that they have, at least, reaped some of the reward so justly due to them. It would be a great satisfaction to me if I could obtain their names and addresses. I might probably give them some valuable information concerning the proportions of the machine, and the power to be used, for I notice that they have made some grave mistakes in their calculations.

Now, for the benefit of your numerous readers who are interested in aerial navigation, I would be pleased to have you give them an illustration of the apparatus in question, as you have a full size working model within your reach. You might add to it a parachute, closed like an umbrella, and attached to the top end of the center iron shaft; in case of a too rapid descent, it would open of itself.

I should also suggest to Mr. Paine, that now is his chance to elevate prominently before the people his new electro-magnetic motor; and if he will furnish the power, I will furnish the propeller, and we will both seek a more suitable planet for our advancing ideas.

New Orleans, La. SAMUEL TRUDELL.

Paine's Perpetual Motion.--A Reply to Dr. Vander Weyde.

To the Editor of the Scientific American:

I have read Dr. Vander Weyde's elaborate article in your journal of July 15th. I cannot allow him to assume that I have made certain statements, and then proceed to demolish them. I have never said or written that I could drive the largest ship afloat with any amount of zinc. My language was, "the forces developed by the action of a single Bunsen cell, *if* utilized and converted into power, *would* drive the largest ship afloat."

Allow me to assure the Doctor that I am familiar with all the authorities he quotes, and with many of them have personal correspondence, which I shall be pleased to show him, should he do me the honor to call on me.

If the Doctor knows anything of the subject he has undertaken to discuss, he knows that in order to obtain the dynamical (not voltametrical) value of four 8 inch Bunsen cells by magneto electricity, we would require a power on the best constructed of the magneto-electric engines of at least three horse, which greatly exceeds the duty of the engine that is to operate it, and thus easily is the grand structure of the Doctor tumbled down. Mr Paine's perpetual motion only exists in somebody's mind who is evidently hurt. When I obtain perpetual motion, I shall probably know it as soon as the Doctor.

If the Doctor will have a little patience, and carefully read some of the articles I am preparing for your paper, he will learn that it is possible that there are some things that neither he nor his authorities are familiar with.

Newark, N. J., July, 1871. H. M. PAINE.

P. S. I have no fears that your readers will misconstrue the sense in which I used the word "peer," in a former communication. H. M. P.

The Depths of the Sea---No. 1.

To the Editor of the Scientific American:

Astronomical calculations of the equinoxes show that by their advancing during a period of 10,000 years, an inundation alternately of each half of the earth's surface, the northern or southern hemisphere, is produced, the other half rising during the same period from the water.

The northern hemisphere has now about seven minutes longer winter than the southern, which, in 10,000 years, gives such an overflow of ice and water on our side of the globe, that it will be, in the time stated, covered up to the equator. We now have come almost to the middle of this period; the advancing of the ice from the north pole towards the equator has been perceived during several centuries past. Greenland long ago lost its vegetation, its green garment, from whence its name is derived; it is now merely a "white land," vailed in ice and snow entirely. Iceland is following; two thirds of its surface is really ice land, for on its southern extremity only there exist a few colonists.

In the course of 3,000 years the northern hemisphere of our globe will be entirely under water; our cities and villages, with their palaces and magnificent buildings, their splendid churches, and spacious halls of science and art, their warerooms, houses, and humble shanties, will once more form the bottom of the endless main—as has been often done before. Culture and civilization will be concentrated again on the southern hemisphere, from whence they formerly had wandered over to our northern half of the globe. How often may this revolution of the earth have passed, how often will it still take place, and who is able to measure it? The immense depths of the oceans are wrapped in an impenetrable vail of mystery—as are many other things which our earthly science is unable to discover. How many fancies may be occupied by these unfathomable depths! For there is nothing on earth more interesting to us than that which is unknown—but yet full of presentiment; though, as yet, it has yielded but little to our investigations. So much, however, is known: That the bottom of the sea is not a gloomy or a volatile wilderness or a barren rock; it is no open grave, ready to bury forever the fragments of ships or the convulsive limbs of drowned men. It is no place where death alone is ruling in its dreadful glory. Munificent Nature, always creative, has not abandoned the valleys of the sea to eternal silence and obscurity. All-vivifying light penetrates even into these unexplored regions; splendid water plants trim the rolling bottom of the sea; animals of the most various species and classes wander through these endless abysses. Here meet a world of fantastic creatures, whose forms resemble the first oddly shaped inhabitants of our globe, whose remains are still inclosed in the petrified layers of our mountains. The bottom of the sea, being only submitted to natural changes and revolutions, and not to those caused by men, bears more traits from the primitive world than the surface of the earth. The productive hand of the master of the earth is not in action on the bottom of the sea, except in the mournful accidents of shipwreck, when man's productions are drawn down to these depths, either to be dissolved into their atoms or to lie untouched in an eternal grave.

Important revolutions have passed, and are still going on, at the bottom of the sea; but, alas! man cannot penetrate far enough into these mysterious depths. There may live creatures, whose huge, ill shaped forms would terrify us; and others, which are organized so delicately, that our senses are not able to perceive them. The whale and narwhal, the polypi and radiates live here. But the constitution of the human body does not allow us to be far from the surface of the earth, neither up to great hights, nor down to great depths. Although, in proportion to the immense circumference of our globe, the elevations on its surface are not larger than the protuberances on the skin of an orange, yet man is so impotent, that even high mountain peaks are often an insurmountable obstacle to him. How should such a feeble creature, which, in order to live, has to respire ten times every minute, be able to penetrate into depths extending down a great many miles?

The air, by which we are surrounded, presses upon us with a weight equal to that we would have to bear if we were on the bottom of a sea, whose surface would be at a distance of ten miles above our heads. This pressure decreases in the same proportion as we climb up high mountains, or rise in a balloon to a considerable hight. The pressure of the air is necessary to keep the blood, flowing in our veins, within its proper limits. The higher we rise, the thinner the air is growing, the more and oftener we have to take breath; the skin is swelling painfully, our organ of sight grows dim, we turn giddy or even faint away. At a hight of 7,000 meters, the greatest which man has ventured to reach, there is such an intense cold, that our limbs grow stiff; the air, being now too thin, is no longer the carrier of sound, we grow deaf; the blood, no longer retained by a sufficient pressure of the air, squeezes through all the pores on the surface of our skin; the pulsation of our heart is slower; now we have to descend immediately—a few moments longer, a few steps higher—and it will be too late!

In descending into the sea, we are still more unavoidably exposed to danger. At a depth of 20 meters, a weight three times larger than that of our atmosphere is pressing upon our organs. To descend further is very dangerous, for a much heavier weight will press upon us. At a pressure four times as great as our atmosphere, upon the surface of the human body, that is, at a depth of about 140 feet, our blood, being charged with a too heavy pressure, and consequently compressed too much in all our limbs, flows back towards the inner organs; the color of our skin turns leaden; the heart stagnating, pulsates slowly; and torpidity, a true harbinger of death, reminds us of the danger, which would inevitably be the consequence of a prolonged sojourn in such a depth of water. We can hardly remain one minute under water without taking breath. On the island of Ceylon, where pearl fishers practise from their youth the art of diving, they nevertheless seldom succeed in remaining three minutes under water. Of course, we can, by means of a diving bell or another artificial mechanism, carry a small portion of air under water and renew it from time to time; but, although such an artificial apparatus enables man to remain 3 or 4 hours under water, yet it cannot lessen the effect of the pressure of the air, which becomes condensed more and more, in proportion to the descent. We can, by means of such a diving apparatus, repair piers of harbors, bring treasures, lost in shipwreck, again to the surface of the water; and more, such an apparatus enables the raising of sunken ships. We can by means of it with ease work under the water, at a depth of 120 feet, but there is no medium in the world, by which we could descend into the depths of the oceans; yet the production of its depths are carried up by the plumb line to the surface of the water.

La Place, the mathematician, and renowned author of "The Mechanism of the Heavens," has proved radically, that the deepest valleys of the sea cannot extend further down than 8,000 meters; and very often does the plumb line in the main sea reach the bottom at a depth much less than that. If the oceans could be drained we should see immense regions of land, composing extensive plains and pleasant valleys; lofty mountains and deep, dark ravines and abysses, extending as far down below the general surface of the earth as the highest peaks of the mountains rise above it. The depths of the sea were formerly involved in a nimbus of odd theories. These strange illusions are now cleared up entirely; the sea is no longer waving around the fluid interior of the earth; fancy, which so readily deepened the abysses of the sea *ad infinitum*, has now to be contented with a knowledge of its dimensions.

In comparison with the diameter of the earth's surface, the sea is only a thin layer of water, spread around our planet like the dew which settles during night around an apple or a plumb. Such a mass of water, however, in which the highest peaks of the Cordilleras can be nearly submerged, leaving only the utmost extremities visible sufficiently to serve as a support for a wavering boat, is something to us, insignificant pilgrims on earth.

There is still an endless, miraculous world to be explored, a world full of mysteries and splendor, which has never been seen before; but, the time cannot be far off when the plumb line of navigators and explorators will give information of it and will reveal, what has been hitherto unknown of the bottom of the deep! The bottom of the sea is as uneven as the surface of the earth—large mountain chains are running along it, the highest peaks of which form islands in our seas.

This submarine world contains, like ours, rich valleys, fertile plains, and barren deserts, but has its peculiar animal and vegetable kingdom and its peculiar sky. There are immeasurable craters, forges glowing eternally, from which boiling hot lava rises and pushes fluid matters up to the water's surface. The Antilles, Maldives, and other groups of islands of volcanic origin, are formed entirely by such eruptions. Navigators often meet, far from any trace of land, hot, sweet water, spouts of large dimensions, rising up with a dreadful roaring, after having penetrated the endless surges of salt water. In the Bay of Xagua, sweet water fountains are breaking forth with such a power, that small vessels cannot approach them. The bottom of the sea is submitted to the same revolutions as the earth's surface; it is not very seldom that these depths are shaken by earthquakes; new islands are raised from the oceans, and the waves devour older ones, known to us long ago. Nature, never resting, can here, by means of raging surges, produce the same devastations which continually take place on some part of the earth's firm surface. What curious things we should see if we were allowed to descend *ad libitum* into these unexplored depths! We should view endless sand plains, on whose volatile downs rest the goods of foundered ships; inheritances of nations, which have become extinct on our globe long ago; and wonderful specimens of antediluvian industry. There we could follow the course of the narrow, winding dales, as if they were arteries of our world, conveying, like river beds, the wild currents, from the poles towards the equator, by which the water of all the oceans is mixed so that an equality of temperature is produced. We should see enormous ranges of mountains and bare rocks, glittering in the bright colors of the jasper, of granite, of silver mica, whose metallic crystal forms reflect, upon their thousandfold edges, all the colors of the rainbow, and form, in many spots, beautiful grottos. A transparent sky of a deeper blue than ours would shine there above our heads, animals of the strangest forms and size would be seen passing to and fro in this transparent sky; gigantic whales would be seen swimming there as comfortably as vultures, when roaring in the air or resting for a moment on the steep, rocky precipices of high mountains. Whose fancy is rich and lively enough to image what a splendid spectacle Nature would display to us at the bottom of the sea: where a weight of 800 atmospheres presses upon everything, where a hollow iron ball, the size of a a man's head, and as thick as three fingers' breadth, would be dashed into dust, like a soap bubble: where gunpowder would fail to drive a bomb shell out of the mortar? Most likely this immense pressure would make the water penetrate through the pores of rocks and other minerals, so that marble would become as transparent as glass; and we might even be able to view, in these depths, the process of crystallization of the minerals, or to find out how their various component parts are combined. But, it seems, Nature does not desire that the human eye should look down into her secret workshop, and penetrate into the great mysteries surrounding us everywhere, but prefers to encourage us to overcome the weakness of our organs by constantly increased activity of our senses.

AMALIE PFUND, *née* JANSSEN.

Extracting Gold from Ores.

To the Editor of the Scientific American:

In your late Australian advices there is reported a discovery of a new agent for the extraction of gold from ores and tailings, and calling attention to its importance to the miners of the West. A large class of your readers are occupied in the different processes for the extraction of the metals, and will hail any information you can give them with great satisfaction. It will be necessary to point out to those who are not occupied in the study of those matters, that there is some little difficulty in the way of its ultimate success. Triturating mercury with sugar is to produce the impalpable powder spoken of, called saccharate of mercury. Its effect on the process of amalgamation requires to be explained.

The only intelligible result of triturating mercury and sugar is to oxidize the former. In this state it may be considered atoms, a state favorable to meet the corresponding fine gold. The condition of things being equal, the sugar takes no part chemically in oxidizing the mercury. Chalk, molasses, and many other substances, have the same effect.

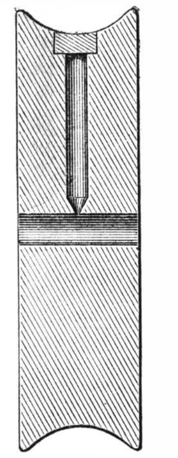
Oxygen, sulphur, and tellurium are not the best combinations of mercury, for reasons that the oxide would be carried off, combined with gold unreduced, and be lost in the subsequent washings.

Again, much of the gold is not in suspension, but is to be found in the matrix, combined with other substances, and requires very different treatment than the one suggested.

Newark, N. J. J. TUNBRIDGE.

Oiling Sheaves.

To the Editor of the Scientific American:



The accompanying engraving represents the section of a sheave, cut through the center to show an oil chamber. The chamber is made by running a quarter of an inch drill into the sheave till the point shows in the center hole. Then follow with a three eighths of an inch drill, say for a quarter of an inch, to get a shoulder for the stopper to go against. If the oil gets out too fast, put a little wool in the bottom of the hole.

I have used this device for several years to advantage, and I believe that this was invented by me. I have sent this, thinking it might interest some of the readers of the SCIENTIFIC AMERICAN. FRANK ALSOP.

McGregor, Iowa.

Steam Plows.

To the Editor of the Scientific American:

The subject of steam plowing, recently so energetically stirred up by H. G. and others, will no doubt continue to be one of the leading topics for inventors to think about, till the machine is brought out. I, for one, am satisfied that the cumbrous stationary engine, or English system, drawing gangs of plows back and forth across the land with ropes, will never do for our wide prairies. Nor do I believe that traction engines moving over the ground at high speed, thereby using up most of their power in their own propulsion, will ever be found economical.

What is wanted is an engine of 10 to 20 horse power, to move slowly over the unbroken ground, and work up the soil behind it as it moves, to a width as great as a system of outrigged spars, shafts, pulleys, draft chains, and mold boards or other diggers attached, can be made to operate in a substantial manner, thus taking along and finishing a " land " of, say 40 or even 50 feet wide, as the whole machine moves forward at a rate of not over one fourth or half mile per hour. I see no difficulty whatever in devising a machine to work on this principle.

A revolving endless chain, or two such chains, working against each other, so as to prevent the machine from being drawn to one side, reaching out twenty feet or more upon each side, and carrying shares, or cutters, or diggers of any efficient form, and supported by a framework and an outside idle wheel, could certainly be made to slice off and work up the ground to any degree of fineness desired, or to any reasonable depth. And the forward motion could be so geared down, that but a small portion of the power will be required for that.

The greatest difficulty in the problem of steam plowing on the western prairies, will be the supply of water. A twenty horse engine requires about a bucketfull a minute, and in most localities this will be hard to get. Some system of air surface condensers, will, I think, be found a necessary appurtenance of any portable or traction engine for farm use. This can be made of tin plate, and need not be costly or heavy. A tin pipe four inches in diameter at the escape, and decreasing in size as it lengthened in a coil, supported by light frame work in an airy situation, could be made to condense most of the steam without much back pressure, and thus save the water to be used over. On the Mississippi bottoms this would not be necessary, as water is always near.

Hoping these suggestions may be of use to those able to execute as well as plan, I submit them for the public.

Memphis, Tenn. CHARLES BOYNTON.

A Pin in the Heart of a Chicken.

To the Editor of the Scientific American:

A ruralist's wife, upon dissecting a fowl, preparatory to cooking, noticed a slight enlargement of the heart, and a more minute observation revealed a pin that was imbedded nearly its whole length, near the right auricle of the heart. The pin had worn a small cavity, and was in a corroded condition. The inquiring mind is anxious to know how the pin found its way to this vital and important organ.

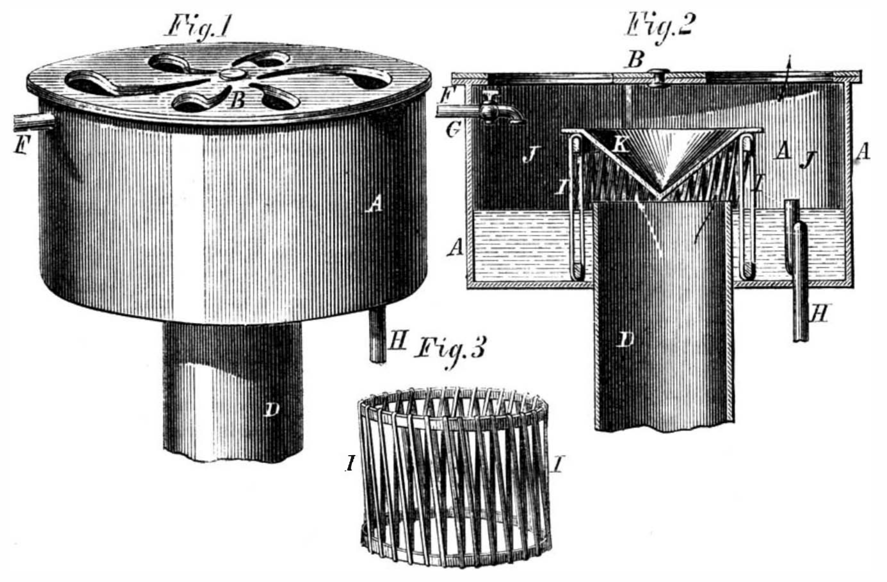
L. G.

[The occurrence narrated by our correspondent is only one of many on record. How sharp pointed articles, like pins and needles, find their way through delicate tissues and organs of the human body to the surface, sometimes by long and tortuous routes, is a mystery which we believe is yet unsolved. The fact is, however, well established.—EDS.

Improved Hot Air Register.

Two serious evils attend the use of hot air furnaces. In the first place, there is a continuous ascension of particles of carbon, dust, etc., which accumulate in the flues, and are carried up with the heated air into the apartments. And, secondly, there is a distressing dryness of the atmosphere, notwithstanding all the attempts hitherto made to charge it with vapor. Both these evils are not only disagreeable, but positively injurious to health.

Heated air has an avidity for moisture, and absorbs it not only from the human body, but from articles of furniture, etc. Advantage has been taken of this peculiarity in constructing the register shown in the accompanying engravings, so that the dry air in passing through the screen, I, comes in contact with, and takes up water, whilst particles of dust, etc., floating in the air, are effectually intercepted. The heated air thus enters the room moist and free from impurity.



McGLASHAN'S PURIFYING AND EVAPORATING HOT AIR REGISTER.

It may be desirable to have the atmosphere in an invalid's room medicated. To accomplish this, a solution of the drug is placed in the water tank of the register, and thus the air is impregnated with it.

Lime water in the tank, will, in the same way, rid the air of carbonic acid gas.

A delicate perfume may be communicated to the atmosphere of a room, by a drop or two of essential oil in the water tank.

Fig. 1 is an outside view, showing the appearance of the register when the parts are placed together and ready for use.

A represents the usual casing of a register, its lower part, together with a portion of the flue, D, forming the water tank: the depth of the water (Fig. 2,) being regulated by a discharge pipe, H. An inlet pipe, F, and cock, G, supplies water. The action of the cock, if necessary, may be made automatic by means of an arm and hollow ball.

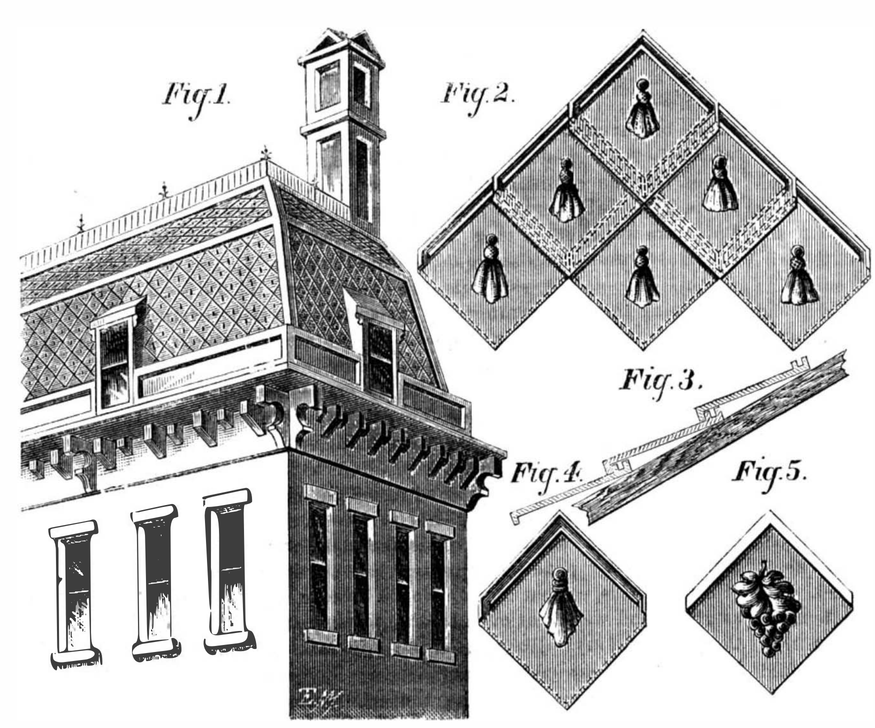
The screen or dust arrester, I, Fig. 3, is a light frame covered with yarn or any suitable fibrous material, which, by its capillary attraction, will constantly absorb water. The lower portion of the screen is immersed in the water. Its upper portion forms a partition in the air space, J, above the water, as represented in Fig. 2. It is surmounted by an inverted conical cap, K, which guides the ascending air through the saturated interstices of the screen, thence through the register, B, to the apartment to be warmed. The screen is movable, and can be inverted at will.

State rights (or the whole) of this patent will be sold. Patented through the Scientific American Patent Agency, June 27, 1871.

For terms, and all other information, apply to J. W. McGlashan, 210 St. James street, Montreal, Canada.

Van Pappelendam's Metallic Tiles.

Our engraving shows an undoubted improvement in the construction of metallic tiles, whereby, it is claimed, perfect security against leakage of roofs is obtained; while, at the same time, a great variety of ornamental design is possible, without much increase of cost over that of perfectly plain tiles. The raised ornamental designs, furthermore, serve to strengthen the tiles, acting as corrugations to prevent rolling up by the action of violent winds.



PAPPELENDAM'S METALLIC TILES FOR WALLS, ROOFING, Etc.

The tiles may be made of iron, zinc, or any other suitable metal, and either of cast or sheet metal, the ornament being stamped thereon when rolled sheets are used. The tiles are shown singly in Figs. 4 and 5, obverse sides of two different tiles being shown. One side of the tile has two parallel ribs formed along two of its edges, as shown, forming a channel. Below these ribs, a single rib on another tile rests, when the tiles are placed together on the roof, as shown in Fig. 2, and more clearly in Fig. 3.

The two angles of the tiles on the right and left are cut off, as shown, and the channel formed by the parallel ribs is bent so as to conduct any water that may pass over the lower ribs, downward, and deliver it upon the upper surface of the next tile below.

By these means, it is claimed that the penetration of water through the joints is effectually prevented.

The tiles may be made square or diamond shaped, either form being ornamental as well as effective.

The tiles thus made will, it is thought, find a wide application in this country and abroad.

Patented through the Scientific American Patent Agency, June 13, 1871, by Cornelius G. Van Pappelendam, of Charlestown, Iowa. The entire right will be sold. Address, for further information, as above.

Xylatechnigraphy.

We lately, says the *Building News*, called attention, in our review upon the furniture in the International Exhibition, to some specimens by Messrs. Trollope, decorated by their new patented process for the decoration of natural wood.

As a process of artistic decoration this invention is a highly valuable one, but a "new art," as they call it, it certainly is not. Although woods have been stained previously, and that in more than one color, by means of stenciling, nothing, as far as we are aware, has hitherto been attempted of the delicate and elaborate character of which this process is capable. By its means every shade, from white to black, buffs, browns, reds, and neutral green are produced, and penciled on by hand with the finest lines if needed, or laid on broadly and with clearly defined edges. Through all their varied tints the natural grain and transparent luster of the wood is retained, and the effect is soft, rich, and harmonious. Indeed, one considerable advantage in the process, according to our opinion, is that it does not seem to lend itself to strong or violent coloring, and that blues and pure greens, which are such dangerous implements in the hands of modern designers, do not make their appearance among the colors employed.

Among the articles to be seen are several doors with highly enriched panels and architraves, the designs of which are good, and the effect striking and pleasing. Another fine example shows the complete treatment of a side and ceiling of a room with dado, cornice, etc. In this are some groups of fruits and leaves, which admirably exhibit the capabilities of the process. In a group of leaves, each leaf may have a slightly varied hue, and thus great variety is obtained. Some specimens of furniture—as sideboards and cabinets—deserve attention, as illustrations of the richest and most elaborate character of work. In many of these gold is judiciously used in the moldings to highten the effect. Articles of bedroom furniture are decorated in a simpler manner, but, perhaps, are not so successful, some of them being rather heavy and dark.

On the whole we were very favorably impressed with this new process, and believe that architects will be grateful for the opportunities it will afford them, as they may have their own designs carried out in exact accordance with their drawings to the minutest details. The work, when done, is French polished or varnished, and the highly glazed surface thus obtained is perhaps the greatest present drawback, but we doubt not that this may be avoided, in which case we think that but little will be left to be desired by either artist or architect.

THERE is a sharp rivalry just now in Alabama among different guano dealers. One of them, by way of showing the superiority of his guano over any other, says that a farmer recently put a sample of it into his pocket, in which there happened to be a carpet tack, and started home on horseback. Before reaching his house his steed broke down, and the farmer was at a loss to discover the cause until he found that the carpet tack had grown to be a long bar of railway iron.

Siphon Recording Telegraphic Instrument.

Sir William Thomson's siphon recorder, which is the great telegraph novelty of the day, is a most marvelous combination of strength and weakness; and the strength and the weakness are so remarkably combined that it produces effects which, until its appearance in public, a few months ago, were totally undreamed of by the most sanguine of telegraph engineers.

This instrument consists of a very powerful electromagnet, between the poles of which (therefore in a magnetic field of great intensity) is suspended a core wound with fine silk covered copper wire. This wire is put in the circuits of the telegraph line, through which the signals are received. The reading of the signals is effected by means of a siphon of capillary glass tube, about two inches long, the shorter end of which dips into a dish of ink, while the larger hangs down, in front of a paper strip moved forward by clockwork. The miniature glass siphon is connected, by a very fine aluminum wire, with the coil suspended between the poles of the electromagnet, and is moved backwards and forwards as it is deflected to the right or the left. To persuade a camel to get through the eye of a needle would, under ordinary circumstances, not be a more difficult feat than to get ink through the capillary tube under ordinary pressure. But the way in which it is got through it, and not only got through it, but actually ejected in a tiny stream from the lower end of the siphon, is by the simple and ingenious expedient of keeping the ink electrified to a high tension. It is a well known fact that, when any liquid is electrified, its particles repelling each other, it is enabled to flow through the finest orifice; and this fact, judiciously taken advantage of by Sir William Thomson, has enabled him to produce a frictionless pen point. The electrification of the ink in the reservoir is done by a rotating electrophorus or replenisher, kept in movement by an electromagnetic machine.

A Nonsensical Patent.

A Mr. Macdonell, of London, England, "believes that if he fits the poles or shafts of carriages with large wheels," which he is pleased to term "auxiliary horse wheels," these wheels having received "the initial force of the horse or horses," will, by tending to keep in motion, help to draw the carriage behind them! To facilitate the motion, Mr. Macdonell proposes to load the axles with weights to increase the adhesion between the "auxiliary horse wheels" and the road.

A patent has been granted for this device, in Great Britain. See "Pickwick," chapter 2, wherein the cabman says, "We've got a pair of precious large wheels on; and when the horse does go, they run after him, and he must go on he can't help it."

Tamping Apparatus for Blasting.

Daniel Corgan, of Sugar Notch, Pa., has invented an improved tamping injector for use in blasting. It consists in a tamping injector, having a cylinder or barrel with a handle or rod connected therewith. The tamping material is placed in the cylinder or barrel. A rod, the end of which is made to fit the inside of the barrel, so that it may act as a plunger therein for forcing out the tamping material into the drill hole, where powder or other explosive substance has been placed, is also used. The cylinder is bent slightly inward at the lower end, so as to prevent it from being drawn off the plunger, whose head or upper end is made larger than its body or remaining portion. A stop prevents the plunger from passing entirely through the barrel. The diameter of the barrel is slightly greater than that of the drill hole. The end of the barrel is placed so as to inclose the drill hole, and the tamping material is forced into the hole and pressed by the plunger, so that it will remain in a hole drilled upward into a seam of coal, which is worked from the bottom, as is frequently the case in mining anthracite coal. When the tamping material has been pressed into the hole, the tamping bar is applied, by which the material is rendered as compact as may be desired. By the use of the tamping injector much valuable time is saved, and the risk to life and limb from this dangerous occupation is greatly lessened.

BY having his wits about him and a plentiful supply of eggs, Mr. Joseph Hale succeeded in saving the life of his wife, recently, in Portland, Maine, who, in a fit of abstraction, had swallowed a dose of corrosive sublimate, thinking it was laudanum. Given over by the frightened neighbors for as good as dead, her husband at once administered to the terrified victim the whites of fifteen eggs, which completely neutralized the effects of the poison.

IN Massachusetts recently, a lady overtaken by a thunder storm, suddenly felt a shock of electricity which numbered her, but, recovering almost instantly, she continued her walk home. On arriving, she found that the lightning had actually struck a fold of her black alpaca dress, near the ground, where it was wet by the shower, and had scorched the edge of the fold, and then leaped off to the wet ground.

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MENTAL ORDER AND SYSTEM.

We are all tolerably familiar with the fact, that no generator of power approaches in efficiency the half of its theoretical capacity. In the best modern steam engines, the conversion of ten per cent of the capability of the coal into efficient power, is an unusually high result. The loss in the use of electro-magnetism is still greater in proportion. And, labor as we will, we shall never arrive at absolute perfection in the use of force generators, if we ever approach it.

But what shall we say of the enormous waste of a force, more powerful than steam and more subtle than electricity, which goes on daily within us? How much of our mental capacity is lost, through desultory habits of thinking, and loose, irregular exertion of the mind? We believe that the actual product of the brain's working through the day is lamentably below its possible achievement, and the cause of this we propose to consider.

The faculty of concentrating the mind on the matter in hand, to the exclusion of all other things, is one of the rarest and most valuable gifts with which a man can be endowed. To commence with a theory, to think it out to its legitimate results, to reduce those results to a concrete form, and, if it be in material science, to proceed to experiment and practice, without diverging, in any direction, from the purpose, is possible to very few men. And we do not think we are overstating the case when we assert that, in proportion as a man is gifted with this faculty, he will become a successful investigator of the phenomena of Nature. Certain it is, that the most eminent men in the scientific world have been remarkable for this power of self-concentration; and the study of Nature and her laws—which go from process to process, and from fact to fact, by strict induction and with inexorable logic—is the pursuit of all others, for the employment of this invaluable talent, as well as for the increase of its strength. The study of Nature—in another word, science—is the best occupation for the mind, if it be desired to systematize the thinking faculty, and to produce the greatest result from the exertion of the intellect. It is one phase of the same power, of which thoroughness of work is another; for, if the ability of mental concentration can be acquired, it is by doing most thoroughly and earnestly the work in hand. So the true worker or thinker never wastes time and strength in going back to what he has already accomplished, but, having done it once, he is prepared for the next process, and so goes on with the least possible dispersion of his mental force. Similarly, the studies of mathematics and logic are useful to mental discipline; and the former, especially, has done the world good service in forming the invaluable habit of reasoning by strict induction.

As a marvellous instance of what one man may achieve by doing systematically and thoroughly whatever he undertakes, we cannot do better than consider the life of Alexander von Humboldt. There was no part of the world he had not visited, and he had been nowhere without acquiring the most exact knowledge of the whole country, its geology, its animal life, its botany, all its physical characteristics, as well as the language, habits, customs, laws, religion, and history of its people. He led this life till he was ninety years of age, and even then no fact, in any part of the world, that had any bearing on scientific truth, escaped his notice. His mind was a museum, where all the knowledge that had been brought into the world was placed in order, carefully guarded, and always ready for use. We are not wrong in attributing the boundless learning and prodigious memory of this great man to his habit of systematizing his mental labor, and to his power of self-concentration; and to his belief in the wisdom of that great command: "Whatsoever thy hand findeth to do, do it with all thy might."

EXTINGUISHING FIRES AT THEIR COMMENCEMENT.

A quick practical means of extinguishing fires at their commencement, on hand, ready for immediate use, in every building, would lessen the annual destruction of property by burning to an extent difficult to estimate.

The rule is that the beginnings of fires are small, and their early progress comparatively slow. There are buildings which contain such inflammable materials that a spark will communicate flame almost instantly to all parts of the structure, but these cases are exceptional. In most cases a very little water judiciously employed will extinguish a fire within five minutes from its ignition.

We say judiciously employed, for in this lies the secret of successful combat with the devouring element. To throw water indiscriminately wherever it may chance to hit, is to waste our ammunition. The attempt should be to cover the burning surfaces with water as speedily as possible. No matter how thin the film of water may be, it excludes the oxygen of the air, and fire can live no more without air than an animal. A thin stratum of any non-combustible material extinguishes it just as thoroughly as though a foot thick were used.

To apply water thus economically requires more refined means than slopping it out of a bucket. In this way, but a little space can be covered; but a bucket of water will cover many feet if well husbanded.

It is for this reason that small portable hand forcing pumps have been approved by the best and most experienced firemen, as the very best means, all things considered, for extinguishing fires.

Those extinguishers employing a solution of carbonic acid in water, or solutions of salts which, decomposed by heat, yield gases that do not support combustion, have some of them proved very useful, but their cost is far more than small force pumps, which answer nearly as well.

We would suggest to inventors that a field is open for the introduction of apparatus of this kind. And there will be room for competition in supplying the demand, as much as in pianos and sewing machines. The attention of manufacturers is especially fixed at the present time upon the subject, and we believe we express the prevailing opinion, when we assert, that portable apparatus, employing only water, is what is regarded with highest favor by this class of men. There are some devices of this kind now in use, but, as we have intimated, there is room for others. The field is large and comparatively unworked. The time will, however, come when something of this kind will be made a condition of insurance, in all buildings much exposed.

GRAPHITE, PLUMBAGO, BLACK LEAD.

Although graphite has been known from time immemorial, and its name at once indicates the antiquity of its principal use, its geological origin is still a matter of doubt, and its properties are not yet half understood. It belongs to no particular geological horizon, but occurs in rocks of all ages, in beds, imbedded masses, laminæ, or scales, more commonly in granite, gneiss, mica slate, crystalline limestone, and occasionally with deposits of coal. The famous Borrowdale variety is found in nests, in trap in clay slate. Nearly every locality presents it in some new association, so that it is scarcely to be wondered at that geologists have been puzzled to account for the origin of a mineral that makes its appearance in utter disregard of the laws of deposition, stratification, injection, or age. The recent progress of chemistry has thrown some light on this subject, and new theories have been advanced, tending to dispute the vegetable origin of graphite and to explain its presence on the principle of the decomposition of cyanogen or of other nitro-carbon compounds. In the preparation of caustic soda, cyanide of sodium is produced, and when, in the course of the operation, Chili saltpeter is added, to oxidize the sulphides of iron and sodium, and the mass is in a state of fusion, graphite arising from the decomposition of the cyanide rises to the top, where it swims and can be skimmed off, washed and dried, when it presents the appearance of brilliant, light powder, perfectly pure and admirably adapted to the manufacture of pencils and many other purposes. We need hardly say that in many soda ash establishments, the graphite produced in this way is economized and highly valued on account of its great purity. The brilliant red crystals which form in blast furnaces, and now and then give rise to what is called "salamander," were formerly supposed to be pure titanium. Wöhler afterwards showed that they contained cyanogen, and this discovery, together with the appearance of cyanogen in the soda ash manufacture, has led chemists to suspect that the formation of artificial graphite in iron furnaces is not always due to the solution of an excess of carbon in the molten iron, but may be referred back to a compound of nitrogen with carbon, in other words, to the decomposition of cyanogen.

Applying these observations to geological phenomena, some authors, especially Wagner, seek to account for the formation of graphite in nature, on the principle of the chemical decomposition of the cyanides. It is certainly a very ingenious theory, and has many strong points to sustain it; and as it may finally conduct us to an artificial method for the production of graphite, in any quantity and at reasonable rates, it deserves the careful study and experimental research of all parties interested in the development of this branch of industry.

Scientific men have long been in the habit of describing graphite as a variety of carbon. They call it an allotropic condition of carbon, as the diamond, charcoal, etc., are considered to be different forms of this element. This explanation has been quietly accepted until recent times, when the progress of research has disclosed so many new properties for graphite as to entitle it, in the opinion of many authorities, to an independent position among the list of elementary bodies. It has been proposed to call it graphon or graphium, but no writer of chemical text-books has thus far been found to adopt the new name in his list of elements.

Berthelot has found that there are three distinct varieties of graphite: 1. The native; 2. The crystalline, from cast iron. 3. The electric, from the galvanic battery. These give rise to characteristic and different chemical compounds, the perfection and properties of which he describes in a learned paper on the subject.

Brodie has also explained the striking differences between charcoal and graphite, and has shown how to prepare pure graphite as well as graphitic acid. Older and more familiar writers on the subject describe two kinds of native graphite—the crystalline and the granular.

The value of the article for commercial purposes does not depend upon purity, but on grain and texture. The crystalized graphite of Ceylon, with only 1½ to 6 per cent impurities, is not fit for lead pencils, whereas the Borrowdale black lead, with sometimes 13 per cent foreign matter, is the best in the market.

A compact, grainy variety is preferred for pencils, and a loose mold, with shiny particles and scales, is better adapted to crucibles. The best crucible material is really gneiss containing 35 to 45 per cent graphite; this is reduced to fine powder, mixed with one half or one third clay, stamped into forms and moderately heated.

Many attempts have been made to purify graphite in order to fit it for the various purposes to which is adapted. Some of these may be mentioned as offering suggestions to practical men. The most famous method is the one invented by Brodie, which consists in adding chlorate of potash in the proportion of one twentieth to one sixteenth of the original pulverized graphite and afterwards stirring in twice the weight of sulphuric acid, sp. gr. 1·8, and heating gently and with great caution, to avoid explosions, until the evolution of fumes of chlorous acid has nearly ceased; the mass is allowed to cool, and is then washed by decantation in water. After drying, it is calcined in a furnace at a red heat, and the resulting mass triturated with water, upon the surface of which the finely divided graphite swims while the heavier particles of silica, iron, and other impurities sink to the bottom.

Graphite obtained in this way is absolutely pure, and possesses properties different from the original article. It is admirably adapted to the manufacture of pencils, for glazing powder, for crucibles, for electric conductors, and the like. Where the native material contains considerable silica, some fluoride of sodium may be added in the first stage of the process, after the evolution of chlorous acid has ceased, by which the excess of silica is removed in the form of a fluoride. Winkler purifies graphite by finely pulverizing, mixing with equal or double weight of a mixture of soda and sulphur, fusing and ultimately washing with dilute hydrochloric acid. Boiling in caustic soda, and subsequently fusing with soda, and washing in hot water has also been recommended. Other methods have been tried in this country and Europe, but as they are the result of costly experiments, the details of the improvements have not been published.

The most extensive establishments for the manufacture of black lead crucibles are at Passau, in Bavaria; at Battersea, near London; and at Jersey City. Enormous quantities of graphite are now consumed in the market, and it is said that $600,000 worth per annum is required for stove polish alone.

It may be well to mention some of the chief uses to which this valuable article is now applied. The best known are for crucibles, stove polish, glazing gunpowder, lead pencils, linings for iron castings; to these may be added the great use in galvano-plastic and electro plating; the manufacture of cements; as a priming for all colors in painting boats, roofs, iron ships, tin ware; for lining to acid tubes; for packing steam joints; as a lubricator; in the manufacture of Bessemer steel; as a substitute for emery; as polishing powder; for copying impressions, and in photography; for printing ink; to stop the incrustations of boilers; as a wash for trees; in repairing roads; in agriculture; as an antiseptic; as a coating for barrels; for electric conductors; in fireproof safes; and many other applications to which we cannot refer in detail, for want of space. We have said enough to show that, although the progress of our knowledge of graphite has been considerable, there still remains much to be learned, both in reference to its properties and its employment in the arts.

INFRINGEMENT TRIAL.

This was a recent action for infringement brought in the United States Court, Illinois, under the patent granted to William P. Heffron, July 23, 1867, for an improved boiler tube cleaner, against the Chicago, Alton and St. Louis Railroad Company.

One of the leading features of the patent consists in the combination of traveling feed wheels and a series of revolving cutters or cutter heads.

The defendants had not made use of the identical device shown in the patent, but had used an improved device, namely, the patent for a machine for cleaning and polishing tubes, granted to Horace S. Smith and William Hughes, March 1, 1870.

The Court instructed the jury, among other things, that plaintiff was not confined to an apparatus identical with his model and specifications, but might make use of any other form of apparatus in applying his principle which would suggest itself to a skilled mechanic, no inventive genius being necessary to originate it. However much Smith & Hughes might have improved the Heffron machine, if they made use of the combination of the feed wheel or rollers with a revolving cutter head, it was an infringement. The jury returned a verdict of $720 damages in favor of the Heffron patent.

THE THREADED ENVELOPE PATENTS.

In recently publishing illustrations of the threaded envelope patents—the original, of Phelps, covering the insertion of the thread, and the subsequent patent of Gregg, covering the knotting of the thread—we had no purpose to cast discredit upon the Patent Office, much less to reflect upon the action of the able and worthy examiner, to whom belongs the supervision of all improvements of the class. That gentleman is well known as a painstaking, efficient officer, whose services are of great value to the Patent Office, and we should be the last, knowingly, to do him an injustice.

On examination of the full specification of the Gregg patent, we find that the advantages of the improvement are fully set forth: and there was probably as much reason for its issue as for the grant of the original patent. Both inventions are of more importance than most people would suppose, if we may judge from the curious fact that no less than forty-three applications for patents have been made by other persons for substantially the same thing since the issue of the Phelps patent, all of which were necessarily rejected.

The duties of an examiner at the Patent Office are oftentimes peculiar and difficult; perhaps nothing is more perplexing for him than the decision of some questions of novelty. Especially is this true in cases where the devices are simple and the resemblance close. A wrong decision may prove to be a great injustice. In hundreds of instances of small devices, having what at first seemed scarcely a first point of novelty, the subsequent development of the patents has proven them to be inventions of decided importance.

Not the degree, not *how much*, but has the invention *any* novelty and utility, is the question for the Examiner to determine. In some cases it is impossible to decide this question except by the results produced.

The enlightened Examiner will read the laws with a liberal mind, gladly giving to the applicant the benefit of any doubts he may have upon the propriety of granting the patent. He will moreover be impartial in his decisions, treating all applicants alike, whether their inventions are great or small, applying in each case the same general tests of practicability.

[Special Correspondence of the Scientific American.]

WHAT IS DOING AT THE PATENT OFFICE.---GREAT NUMBER OF APPLICANTS FOR EXTENSIONS.

Washington, D. C., July 11, 1871.

The late extension of Kelly's patent for the manufacture of steel, referred to in your issue of July 1, is causing much excitement, the opponents making a fiery onslaught upon the Commissioner and Examiner, in the New York *World* and other papers. A vigorous reply is daily looked for, as well as the Commissioner's decision, in full, which has not yet been made public, though the extension was granted almost immediately after the hearing. Perhaps no extension was ever opposed by so many and weighty capitalists and corporations.

The current month carries a full share of extension cases, and some will be strongly contested, such as the patent to John B. Slawson, for the well known car fare box, used on street cars for the purpose of preventing fraud, and dispensing with the services of the toe-treading conductor; the patent to Arnton Smith (deceased) for a plow: the patent to Charles Winslow for elastic gore cloth, to be contested by the National Rubber Company; also, the patent to Levi Bissell for locomotive truck, contested by the Brook Locomotive Works. Other applicants to be heard this month are W. R. Fee, for hulling cotton seeds; Baxter D. Whitney, for smoothing plane; Alfred Monnier, for manufacture of sulphuric acid; Beniah Fitts, for planing machine feed roller; Wm. M. Welling, for factitious ivory; Isaac Hayden, for bobbins for roving and slubbing. The application for an extension of Smith's patent was made in 1868, and refused, but Congress, last winter, passed an act authorizing a re-examination of the case.

The patents issued during the last six months number 5,913, designs not included, a falling off of about 500 from corresponding period of last year. Being curious to draw a comparison between the several States, as to their relative interests in the Patent Office, I have examined the issues of the last two months, as likely to give an approximately fair guide, and find that New York received 216; Pennsylvania, 110; Massachusetts, 100; Illinois, 78; Ohio, 65; Connecticut, 54; Indiana, 41; New Jersey, 33; Maryland, 26; Missouri, 22; Michigan, 20; Wisconsin, 19; Maine and Rhode Island, each 15; Iowa, 13; California, 12; Virginia, 11; Kentucky, 10; Vermont, 9; Louisiana, 8; Georgia, 8; Delaware, 6; New Hampshire, 6; Texas, 5; North Carolina, 4; Kansas, 3; West Virginia, 3; Tennessee, 3; Mississippi, 3; Arkansas, 2; Oregon, 2; South Carolina, 1; Nebraska, 1; Florida, 1; Minnesota, 1; Alabama, 0; Nevada, 0.

It is encouraging to note that of these 926 patents, 113 were issued to inventors in the so-called slave States, and among them we find a great variety; not only cotton gins, cotton planters, cotton cleaners, and other machines pertaining to this particular branch of agriculture, but also a car coupling, a wood pavement, firearm, bridge truss, canal boat, steam engine piston, etc., etc. Gibbs, of the firm of Willcox & Gibbs, is a Virginian, and Slawson, already referred to, is from New Orleans.

It is quite apparent that the abolition of slavery has stimulated invention at the South, especially in the class of mechanisms connected with agriculture, the records of the Patent Office showing that the applications for patents of this kind have increased from two per cent, before the war, to nearly thirty per cent of all cases filed; and the improved methods of cultivating cotton are already affecting the average yield.

In the class of inventors connected with railroads, there is no abatement of interest nor lack of talent. What greater boon to the traveling public than a well arranged sleeping car, or a Pullman palace car! Whole trains are now made up exclusively of palace cars, and they return immense profits to the company that owns most or all of them, from 200 to 300 per cent, it is said. Consideration for the comfort of human travellers, combined with a clear eye to the dividends, has given rise to equally substantial improvements in transportation cattle cars. Excellent contrivances have already been patented, and new applications are made. Under the old and still common mode of transportation, the animals suffer an average loss, or shrinkage, between St. Louis and Philadelphia, of fifty-seven pounds each; ten or twelve days are consumed in the transit; five or six stops, or even more, of twelve hours each, are required for unloading, feeding, rest, and reloading; and, on an average, two animals in each car, are killed or maimed by falling and being trampled upon, or by some other accident. Under the new arrangement, at least one half the shrinkage is saved, no injuries are incurred, and the time is reduced to five, and even four days, as no stops are necessary, except for supplies of fresh water. The cattle are placed in separate stalls, necessarily narrow, but wide enough to allow of lying down. The partitions are thin, to economize room, and are constructed of wooden slats and ropes, or of canvas, so that they can be rolled up out of the way on the return trip, the cars then being used for ordinary freight and merchandize. These partitions are, however, so firmly secured as to support the animals, and prevent them from being thrown down by the sudden starting or stopping of the train, a very common occurrence in the old fashioned car. Food and water are supplied from the top of the car, through suitable openings and connections, and a tank of cold water is so placed as to give the cattle an occasional shower bath in warm weather.

A successful construction and arrangement of these devices presents an inviting field to the practical inventor. The railroads to the Pacific and Southwest are developing a large cattle trade with Texas, the cattle being driven in large herds across the plains to various points on the Kansas Pacific and Union Pacific roads, and even as far north as Sioux City. Such places as Cheyenne, Schuyler, Laramie, Abeline, Kansas City, and others, have already become great center posts for this traffic, and at some stations eighty-five car loads are shipped daily. The Texas cattle, born and reared in woodland, or on the wide plain, and having the free range of an extended tract of country, are semi-wild creatures, very unlike the mild and domestic occupant of the farm yard; and an ordinary car filled with them, fretting under their imprisonment, and striking right and left with their wide branching horns, does not present a "happy family" for Barnum, but with a "stalled ox," and "a dinner of herbs," the "hatred therewith" is effectually banished.

The manufacturing establishments of the two companies who are introducing these improvements are located at Chicago, Ill., and at Salem, Ohio, and negotiations with the railroad companies are in progress, which will soon establish them as essential parts of the transportation system between the West and the seaboard.

Mr. Amos Rank, the President of the Salem company, is a leading inventor in this class of improvements.

Last winter an attempt was made in Congress by some humane member to pass such enactments as should compel all railroads to make more merciful provisions for the transportation of all live stock, both in the construction of the cars and in supplying food and water on the train at suitable intervals. The bill, however, was not passed. Did the members quote Paul's inconsiderate remark to the Corinthians: "Doth God take care for oxen?"

The allusion to Texas reminds me of a patent just granted to a photographer of that State. Can you, good reader, discover any close relation between the modern art of photography and the ancient amusement of swinging, a very ancient amusement, it having, no doubt, originated with our honored progenitors, the monkeys? You are aware that the long standing and momentous problem of the art referred to is, how to get good pictures of children. The Texan has solved it. He places the infant, whether of days or years, on a swinging platform, together with his camera, and both are then set in lively motion. To the innocent sitter peace and quiet are imparted, to the delight of the fond parent and abundant satisfaction of the operator.

Have you recorded another recent invention, illustrating the fertility of human genius, namely, a garter constructed of two dissimilar metals, in the form of delicate coiled wires, to create a galvanic current around the leg as an effectual cure of rheumatism? ‡

INTERNATIONAL INDUSTRIAL EXHIBITION AT BUFFALO.—The Mechanics' Institute of Buffalo, N. Y., announces a second exhibition, to commence on September 18, and to remain open until October 14. The managers state that they are induced to make this announcement by the great success of, and public interest in the first exhibition, which took place in 1869. The building (the Skating Rink, on Pearl street) will be ready for the reception of goods on and after Monday, September 4th.

PHOTOGRAPHIC NOTES.

A CONCENTRATED IRON DEVELOPER.

Mr. Edwards has found that the addition of a small quantity of copper to the iron developer hastens action, secures immunity from fogging, and brings out the finest details without impairing the contrast of shadows. He prepares a stock solution as follows: Protosulphate of iron, 1 pound; double salt of iron and ammonia, 1 pound; sulphate of copper, 1 ounce; water, 40 ounces, or enough to make a saturated solution. When required for use, take one ounce of the stock solution, dilute with 16 ounces of water, and add an ounce each of acetic acid and alcohol, but their proportions may be varied to suit the requirements of temperature and the special class of work.

There are advantages in having a stock bottle ready to be diluted and mixed when about to be used, and for the tourist who employs the wet process, it is an invaluable method of working, as it is very portable, and can be modified by the addition of one or another solution, to suit the character of the work. A little nitrate of silver solution can be used as an intensifier, if required.

PURIFICATION OF OLD NEGATIVE BATHS.

Worn out negative baths are usually got rid of by precipitating the silver, reducing to metallic state, fusing, and again dissolving. This is a process so long and complicated that most photographers shun to make it, and pour their old baths into the general receptacle for slops, to be sold or got rid of in the easiest way possible.

Mr. Brooks in the "Year Book" proposes the reduction of the negative bath to carbonate of silver to purify it. Dilute the bath to about three times its bulk with distilled water, neutralize with carbonate of soda until a slight turbidity is produced, and sun for several hours; then decant, if necessary, and add sufficient carbonate of soda, free from chloride, to precipitate all of the silver as carbonate. After well washing this precipitate in water, it is in condition to be dissolved in nitric acid of a proper strength to yield a new negative bath.

PAPIER MACHÉ TRAYS.

There is no reason why dishes, trays, pails, bottles and other utensils for photographers' use should not be made of papier maché. This material is not liable to shrink or break. it is very light, unacted upon by acids, impervious to water, unaffected by silver, and is in every way preferable to ordinary porcelain. The difference in cost as compared with porcelain, is now quite trifling.

NEGATIVE PRESERVERS.

All sorts of contrivances have been suggested for preserving negatives, but most of them are cumbersome and expensive. It is now proposed to put them into paper envelopes, and set them aside in boxes, after they have been properly designated. The paper protects them from rubbing, and the expense of grooves, partitions, slides, and other contrivances is avoided. They occupy the least possible bulk when put up in this way, and if laid on edge in boxes, like shelves, can be readily removed in case of fire. Envelopes are now made of the sizes to fit the glasses usually employed by photographers.

HOT CAST CRYOLITE PLATES.

These are now made in this country perfectly flat, from three sixteenths to one quarter inch in thickness, and are ground on one side and polished on the other. They are a great improvement on the milk glass and porcelain, formerly used by photographers. Being of a pure white color, rich tones and beautiful results are easily obtainable. Their flatness and thickness render them secure from breakage.

AN AUXILIARY NEGATIVE.

One of the novelties introduced at the Philadelphia Convention, was a negative for producing a watered or grained effect over such parts of the print as may be desired. The result is obtained by printing for a few moments under a fixed position, and then changing ever so little the position of the auxiliary negative. Imitations of watered silk, also of grains of wood can be readily obtained, and serve to give a new character to the picture.

The East River Bridge.

We have received further intelligence of the progress of this work, which informs us that the tower on the Brooklyn side is fast progressing.

Mr. Martin, the superintendent in charge, reports that not the slightest settlement, even under the enormous weight of the structure, has taken place, nor is it possible that it should, the foundation being solid and absolutely immovable. The work is going on well, and the building on the Brooklyn side having given the engineers experience, and the necessary apparatus being at hand, the New York caisson will proceed much faster than did its sister structure.

The Brooklyn tower, an erection of immense solidity of construction and material, has already reached a hight of some 30 feet above high water mark, and is intended to be 270 feet in hight. It is 100 feet in length by about 170 in width as the river runs, and is built of solid stone, each block weighing several tuns, the interstices between the blocks being filled in with Rosendale cement, which, when thoroughly dry, is as hard as the stone itself.

In the center two large square spaces have been left open, the tower, in the opinion of the engineer, losing nothing in strength thereby. It will be continued to the top on the same plan. When both towers are finished, a span of 1,600 feet will be swung across the river, permitting the passage of nearly all vessels underneath of less than 2,500 tuns burden. Most vessels over that tunnage will be obliged to lower their topmasts before they can pass under.

PROFESSOR TYNDALL ON "DUST AND SMOKE."

On the evening of Friday, the 9th of June, Professor Tyndall delivered a lecture on "Dust and Smoke,' to a crowded audience at the Royal Institution. He began by saying that apparently unpractical and purely theoretical scientific investigations often led incidentally, if not directly, to eminently practical results. With reference to the subject of the present lecture, he had been led to study the nature of dust and smoke in consequence of some experiments he had made as to the condensation of certain gases and vapors, on plates of rock salt, closing the extremities of the glass tubes in which they were confined—an inquiry of really little practical importance. The beam of light used to illuminate the tube was found to be polarized, and this led to an investigation of the dust suspended in the aerial medium through which it passed. Ordinary dust consisted largely, as he had explained in his lecture last year on the subject, of minute particles of organic matter. Of these there could now be no doubt that some were of the character of seeds, and that each particular contagious disease, whether smallpox, typhoid fever, or scarlatina, was spread and propagated by its own particular seed; just as a thistle sprang from a thistle, a grape from a grape, or a thorn from a thorn. Putrefaction of wounds and sores arose from the organic germs contained in the atmosphere coming in contact with, and taking root and developing in, the abraded and exposed tissues of the body. Corruption could, indeed, be in a great measure arrested by simply excluding dust, as had been found by a German professor who had succeeded in keeping blood untainted for a considerable length of time in saucers under glass shades, every precaution being taken to keep out dust.

Professor Tyndall then alluded to the cotton wool respirators, which we believe that he was the first to introduce, and which have been found so effectual in guarding the lungs of those engaged in such mechanical operations as are attended with the production of dust. He read a letter from a seed merchant in the north of England, testifying the benefit derived by the persons in his employ from their use. One disadvantage had attended these respirators in the form in which they were at first constructed. The exhaled carbonic acid, which, as well as the inhaled air pass through the cot ton wool, rendered this soon damp and unfit for use. By adapting two valves to the apparatus, however, the exhaled gas passed, not through the cotton wool as before, but directly from the mouth into the open air, thus entirely remedying the defect referred to.

In consequence of observing the efficacy of this respirator in preventing the passage of dust into the lungs, Professor Tyndall had been led to inquire if it might not also be successfully employed in excluding smoke. A contrivance which would answer this purpose was much needed by firemen, who were constantly required to enter an atmosphere highly charged with smoke. Various kinds of apparatus had, indeed, been suggested with the object of supplying firemen, under such circumstances, with fresh air. One of these—the smoke jacket—was in actual use by the London fire brigade. Through the kindness of Captain Shaw, the superintendent of the force, he could introduce to the audience a London fireman equipped in this contrivance.

Two or three men of the fire brigade then entered the theatre, and one of them proceeded to don the "smoke jacket." This is simply a loose leathern blouse, with a head piece, fitted with glazed holes to look through. The sleeves are tightly fastened at the wrists, and the garment is also secured at the skirts in a manner which, of course, is far from being absolutely airtight, but which nevertheless suffices to retain a considerable amount of air between the jacket and the body of the wearer. A hose is attached to the jacket, and a constant supply of fresh air is forced into it by a pump on the fire engine. Equipped in this manner, the fireman can penetrate into a burning house, and work with comparative ease in a smoky atmosphere. Professor Tyndall, however, pointed out the obvious defect of the contrivance, viz., that it requires the presence of at least a second man with a pump to keep up the supply of air. The fire escape men, he remarked, had frequently to work single handed, and, accordingly, could not avail themselves of this apparatus, which, in consequence, had really not been found of much service in saving life. A Mr. Sinclair had introduced a contrivance which to a certain extent remedied this defect. This gentleman also appeared before the audience wearing his invention, which may be briefly described as a knapsack "full of air communicating with the mouth through an airtight head piece," where, in virtue of its great specific gravity, it remained and accumulated, thus materially assisting in the outflow of the atmospheric air from the upper portion of the chamber.

After explaining these hitherto employed expedients, Professor Tyndall returned to the subject of cotton wool respirators. Experimenting with these in a smoky atmosphere, he had found them useful to a certain extent; but, nevertheless, insufficient to exclude the irritating fumes from the lungs. By moistening the cotton wool with glycerin its action had been much improved; the sticky character of this substance causing the arrest and retention of a larger quantity of the particles held in mechanical suspension in the smoky atmosphere. Still even with this improvement the apparatus was far from completely answering the desired purpose. On reflection it had occurred to him that, as smoke contained, in addition to particles of matter, various irritating gases—chiefly hydrocarbon compounds—the introduction of charcoal into the respirator might increase its efficiency. The action of this substance in filtering water and purifying air was, he said, well known to the audience. Charcoal respirators had been successfully used for some time in hospitals and other places where foul air is apt to be engendered. Accordingly he had constructed a respirator through which the inhaled air passed, first through a layer of dry cotton wool, then through cotton wool moistened with glycerin, and finally through charcoal. This contrivance was a perfect success. He had filled a cellar in the institution with the densest and most irritating smoke which he could devise—viz., that of resinous pine wood, and he found that he could remain in this atmosphere for an indefinite time without any inconvenience.

During the progress of these experiments, he had communicated with the superintendent of the London fire brigade. This gentleman—Captain Shaw—while acknowledging the great value which an effectual respirator of this kind would be to firemen, had been at first a little skeptical as to the possibility of producing a really serviceable apparatus. On seeing, however, the action of this combination of cotton wool, glycerin, and charcoal, he had at once recognized its utility, and thrown himself heartily into adapting the best form of the contrivance to the wants of the firemen. Professor Tyndall then exhibited various forms of masks and respirators, in all of which this principle had been introduced. The firemen themselves were perfectly satisfied with the apparatus. Several of them had tried it in the smoke filled cellar of the Institution, and stated that they could "remain all day" in that atmosphere.

It will, we think, be obvious to our readers that this invention of Professor Tyndall is really a most valuable and important one. These respirators will doubtless be the means of saving many lives and much valuable property. But we venture to think that they ought also to be in the possession of others than firemen.

The inmates of a dwelling and the owners or people employed in a place of business of course know what rooms (if any) are inhabited, who the occupants are, what valuable portable property they have, and where it is deposited, much better than the firemen can possibly learn it on being suddenly called in to extinguish a conflagration. Provided with these respirators, then, the inhabitants of a dwelling might do much to save life and property, either by their own personal exertions or by guiding the firemen. As a preliminary step towards a somewhat more general adoption of this valuable contrivance, we may suggest that it should be supplied to all watchmen and night porters, in places of business and public offices. It ought also to be carried on board of all seagoing ships.

Sleep Walkers.

The sleep walkers who go from room to room, and are very busy in a sort of world of their own, without actually composing new music or writing new compositions, are numerous. The *Morning Chronicle*, in 1822, gave an account of a seaman who slept for a night at an inn in York. Wishing to be called early next morning, and knowing himself to be a heavy sleeper, he directed the chambermaid to come into his room and call him if he did not hear her knock at the door. Waking when the sun was high in the heavens, he felt certain that he had slept far beyond the proper time; but looking for his watch to know the hour, he found that it was not in its place under the pillow where he had placed it. He jumped out of bed to dress, but his clothes were gone; and looking round, he found himself in a strange room. He rang the bell; the chambermaid appeared, and then he found that he had, at some early hour in the morning, left his bed, and wandered in a somnambulistic sleep into another room, for when the maid came to call him he was not in his proper room.

Wienholt relates the case of a student who, when in a somnambulistic state, was wont to leave his bed, go to the parlor or to his study, take out pen, ink, and paper, place music in its proper position on the pianoforte, and play a whole piece through, with his eyes shut. His friends once turned the music upside down while he was playing. He somehow detected the change, and replaced the paper in the proper position. On another occasion his ear detected a note out of tune; he tuned the string, and went on again. On a third occasion he wrote a letter to his brother, rational and legible to a certain point; but it was singular to observe that he continued to write after the pen had lost its ink, making all the proper movements without being conscious that he made no more marks on the paper.

A case is on record of a young lady who, when under the influence of a particular nervous complaint, would walk about the house in a state of sleep or coma, steering her way safely between the articles of furniture, and even avoiding objects purposely placed to obstruct her path. Her eyes were open, but she evidently did not see through them in the ordinary sense; for she entirely disregarded strong lights held close to her eyes, and even a finger that was actually placed against the eyeball. Physicians are acquainted with many evidences of persons who do not see with the eyes, but have some unexplained kind of vision in certain morbid states of the nervous system.

Those somnambulists who wander about in streets and roads, and (like Amina in Bellini's opera) walk along narrow planks in perilous situations, have the muscular sense, whatever it may be, effectively awake. Dr. Carpenter notices, at some length, "the sleep walkers who make their way over the roofs of houses, steadily traverse narrow planks, and even clamber precipices; and this they do with far less hesitation than they would do in the waking state." The sense of fear is asleep, whatever else may be awake. Some somnambulists start off while asleep to attend to their regular work, though under very irregular circumstances. Not very many years ago, a working stone mason in Kent was oo a evening requested by his master to go next morning tne churchyard in the neighborhood and measure the work which had been done to a wall, in order that an account might be sent in to the churchwardens. The man went to bed at the usual time; but when he awoke he found himself fully dressed, in the open air, and in the dark. Presently a clock struck two, and he knew that he was in the churchyard. As he found that he had a measuring rod and a book in his hand, he resolved to walk about till daybreak (it being summer weather) and ascertain what it was that he had really done. He then found that he had measured the wall correctly, and had entered the particulars in his book. Sometimes, instead of starting up from sleep to go to work, persons will fall asleep while working or walking. When Sir John Moore made his famous retreat to Corunna, whole battalions of exhausted troops slumbered as they marched. Muleteers have been known to sleep while guiding their mules, coachmen while driving on the box, postboys while trotting on their horses, and factory children while at work. There was a rope maker in Germany, who often fell asleep when at work, and either continued his work in a proper way, or uselessly remade cordage already finished. Sometimes when walking long distances he was similarly overtaken with sleep; he went on safely, avoiding horses and carriages, and timber lying in the road. On one occasion he fell asleep just as he got on horseback; yet he went on, rode through a shallow river, allowed his horse to drink, drew up his legs to prevent his feet from being wetted, passed through a crowded market place, and arrived safely at the house of an acquaintance; his eyes were closed the whole time, and he awoke just after reaching the house.

Gassendi describes a case of a man who used to rise in the night, dress himself while asleep, go down to the cellar, draw wine from a cask, and walk back to his bed without stumbling over anything. If he chanced to wake while in the cellar, which once or twice occurred, he groped his way back in the dark with more difficulty than when the sleep was upon him. Another Italian, also mentioned by Gassendi, passed on stilts over a swollen torrent in the night while asleep, then awoke, and was too much afraid to cross until daylight came.

The Highest Type of Humanity.

Prof. Huxley, in responding to the customary compliments to science at the Royal Academy dinner (London), said, in concluding his speech: "I will be generous, and acquaint you with a fact not generally known, to wit, that the recent progress of biological speculation leads to the conclusion that the scale of being must be thus stated: minerals, plants, animals, men who cannot draw—artists. [A man who knows nothing but to draw is a draftsman, not an artist. An artist is one who can draw, or give shape to, ideas.—*Ed. Good Health.*] Thence I conclude, Sir, that you, as President of the Academy, are the crown and summit of creation. My statement, however complimentary, may be a little startling, and you will therefore, I hope, permit me to state the grounds on which it takes rank as scientific truth. We have been long seeking, as you may be aware, for a distinction between men and animals. The old barriers have long broken away. Other things walk on two legs and have no feathers, caterpillars make themselves clothes, kangaroos have pockets. If I am not to believe that my dog reasons, loves, and hates, how am I to be sure that my neighbor does? Parrots, again, talk what deserves the name of sense as much as a great deal which it would be rude to call nonsense. Again, beavers and ants engineer as well as the members of the noblest of professions. But, as a friend of mine discovered a few years ago, man alone can draw, or make unto himself a likeness. This, then, is the great distinction of humanity; and it follows that the most pre-eminently human of creatures are those who possess this distinction in the highest degree."

On the Transmission of the Sound of the Human Voice by Rods of English Deal.

An interesting modification of Wheatstone's celebrated experiment of the Telephonic Concert was recently tried at the Central High School of Philadelphia. A rod of English deal, about twenty feet in length and three quarters of an inch thick, was let down through a platform into the room below. Insulation from the platform and the ceiling of the lower room was obtained by enclosing the rod with small sections of thick rubber hose. Against the lower end of the sounding box, a small tuning fork was placed. On speaking or singing into the open end of this, the sounds were transmitted by the rod to the room above, the volume of the sound being increased by placing a guitar on the upper end of the rod.

The experiment is exceedingly interesting and striking. Although the interval between the notes is perfectly preserved, their intensity and quality are changed very decidedly, the effect being similar to that produced by ventriloquism. As the position of the rod is immaterial, striking effects can be produced as though by ventriloquism. A small figure, placed on the end of the rod or on the sounding box, adds greatly to the effect. A song is transmitted in a very amusing manner. As it is preferable to have the sounding box held so that the pulses should impinge in the direction of the length of the rod, the experimenter in the room beneath rested, for convenience, on a settee. This mode of transmission of sound does not, of course, give as good results as by means of hollow tubes, as the transmitted sound cannot be heard at as great a distance. It is, interesting, however, from its novelty.—*By Prof. Edwin J. Houston, in the Journal of the Franklin Institute.*

CLEAN stoves, when cold, with black lead; mix with strong alum water.

The Value of the Calculus as a Study.

It is admitted by all metaphysicians and educators, says the *Technologist*, that the calculus brings into play more faculties of the mind than any other branch of learning. Recognizing this fact, the professors of a scientific school should consider their institution not only as a place for obtaining technical information, but a mental gymnasium; and when this idea is fully comprehended by one commencing the study of the calculus, he will be able to decide, at the first recitation, for what purpose it was put in the course of study. A young engineer desires to have enough mathematical knowledge, not only to understand all demonstrated facts in natural philosophy, all discussions on the division of land and the strength of materials, but also to have a mind which will work smoothly and logically, able to stand the worry and wear of business life, and grasp a knotty subject in all its bearings. Snch intellectual power depends, to a great extent on the amount of talent originally implanted by the Creator; and it is also the result of education, which brings out the latent forces, gives the mind systematic exercise, and enables it to perform its highest destiny. We advance to our conception of the abstract through the concrete; and when once the former is easy of comprehension, the latter requiring a less amount of mental effort, is included. Herein, then is the value of the calculus, and indeed of all other branches of pure mathematics, that by dealing in abstract ideas, they prepare the mind which thoroughly understands them, to apply itself vigorously to profound or complicated subjects more intimately connected with the realities of life. By solving problems in the calculus, the novice is compelled to exercise every faculty of the mind, especially when a new one is given him in the recitation room. All rules previously learned come up before him, memory is often taxed to the utmost, and, when finally the right method is hit upon, what foresight and care are necessary that the long distant final equation may give the wished for result! Such practice is very beneficial; and, if the student will compare his mental powers then with what they were before the study of the calculus was commenced, he will, perceive his improvement. Let those young engineers, therefore, who have an opportunity to study the calculus under good instructors, take it up with the determination of making it as valuable to themselves as possible; believing that every powerful mind will in time find full scope to exercise itself, and command a proper remuneration for its efforts.

The Traveller's Tree.

This is the name given to a tree which grows in Madagascar, so called because the lower parts of its stems contain pockets or receptacles, which in the driest seasons are filled with pure water. The weary traveller is sure to find refreshment by puncturing these pockets with a spear. The botanical name of the tree is *Urania speciosa*. From a solid trunk varying in hight from ten feet upward, and similar in appearance, though not in nature, to that of the southern palmetto, springs up a bunch of stems, each about six or eight feet long, and each supporting a leaf of the same length and some ten or twenty inches wide. The leaves, when dried, form the the thatch of all the houses on the eastern side of the island, making a perfectly waterproof covering, while the stems are used for partitions and sides. The bark of the tree is very hard, and, unlike that of the palmetto, is easily stripped off from the interior soft parts. For large houses this bark is cut in pieces of twenty or thirty feet long and twelve to eighteen inches wide, and the entire floor covered with the same, as well joined as ordinary timber. The green leaves are used by traders in place of waterproof wrapping paper for packages; by the women, for table cloths, and the heavy pieces cut out of them for plates at meals, while certain portions are even formed into drinking vessels and spoons. But the chief peculiarity of this remarkable tree is that, while standing in the forest, the stems always contain a large quantity of pure fresh water, of which travellers and natives make use in the arid seasons, when the wells and streams are dry. To obtain it, a spear is driven a few inches deep in the thick end of the stalk, at its junction with the trunk, and then withdrawn, when the water flows out abundantly, As every one of the twenty, thirty, forty, or more stalks can give from a pint to a quart of water, a large amount is contained in each tree.

American Beet Sugar.

The experiment of making beet sugar in this country has been thoroughly tried by the Germania Company, at Chatsworth, Ill., and the result is not very encouraging. The company owns 2,400 acres of land, and is provided with all the appliances for the manufacture of the commodity, the mechanism having been for the most part imported from Germany.

It is believed that in proper localities this important industry may be made to thrive, and yield handsome returns upon the capital invested. But it appears to be tolerably evident that some other soil than that of Illinois will have to be selected.

Underlying the State of Illinois is an immense deposit of saltpeter, which shows itself in any of the crops, but especially in the sugar beet. In some of the fourth products sent to St. Louis, boiled from molasses, which had been kept from the end of one season to the beginning of the next, no less than ten per cent of niter was found by their chemist. In fact, the fine needle crystals of niter were mixed with those of the sugar, so that they could be scraped off the surface of the mold. This peculiarity of the soils of the prairies renders them unfit for raising beets for sugar making. The lack of good water is another serious difficulty.

In California, the juice of the beet yields from one to four per cent more of saccharine matter than in Illinois.

Quantity Determined by the Spectroscope.

The use of the spectroscope to detect traces of substances has been the most glorious achievement of the chemistry of the last decade; perhaps its employment to determine minute quantities may be the great exploit of the next. As an essay in this direction, may be noticed the interesting contrivance of K. Vierordt, who divides the movable plate of the slit of the spectroscope into an upper and lower half. Each half is provided with a micrometer screw, by which the width of the corresponding slit can be accurately measured. If the upper and lower slit are of the same width, the spectra are of equal strength. If, however, a colored medium be brought before the upper slit, for example, a tinted glass or a solution of a colored substance in a tank with parallel sides, we have two spectra of different intensities. The other slit is now diminished by the motion of the screw until the spectra are made equal in strength, and by comparison the amount of this motion is made to give the amount of coloring matter present.—*Journal of the Franklin Institute.*

Screw Threads, Bolt Heads, and Nuts.

The following standard for screw threads, bolt heads, and nuts, was adopted by the United American Railway Master Car Builders' Association, at their recent meeting in Richmond:

Diameter of Bolt.	Number of Threads per inch.	Diameter of Bolt.	Number of Threads per inch.
1-4	20	2	$4\frac{1}{2}$
5-16	18	$2\frac{1}{4}$	$4\frac{1}{2}$
2-8	16	$2\frac{1}{2}$	4
7-16	14	$2\frac{3}{4}$	4
1-2	13	3	$3\frac{1}{2}$
9-16	12	$3\frac{1}{4}$	$3\frac{1}{2}$
5-6	11	$3\frac{1}{2}$	$3\frac{1}{4}$
3 4	10	$3\frac{3}{4}$	3
7-8	9	4	3
1	8	$4\frac{1}{4}$	$2\frac{7}{8}$
$1\frac{1}{8}$	7	$4\frac{1}{2}$	$2\frac{3}{4}$
$1\frac{1}{4}$	7	$4\frac{3}{4}$	$2\frac{5}{8}$
$1\frac{3}{8}$	6	5	$2\frac{1}{2}$
$1\frac{1}{2}$	6	$5\frac{1}{4}$	$2\frac{1}{2}$
$1\frac{5}{8}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$2\frac{3}{8}$
$1\frac{3}{4}$	5	$5\frac{3}{4}$	$2\frac{3}{8}$
$1\frac{7}{8}$	5	6	$2\frac{1}{4}$

The distance between the parallel sides, of a bolt head and a nut for a rough bolt, shall be equal to one and a half diameters of the bolt, plus one eighth of an inch.

The thickness of the heads for rough bolts shall be equal to one half the distance between their parallel sides.

The thickness of the nut shall be equal to the diameter of the bolt. The thickness of the head for a finished bolt shall be equal to the thickness of the nut.

The distance between the parallel sides of a bolt head and nut, and the thickness of the nut, shall be one sixteenth of an inch less for finished work than for rough.

Too Safe a Safe.

From across the ocean, in the London *Builder*, we hear, for the first time, the following: A mechanic in New Orleans constructed a safe which he declared to be burglar-proof. To convince the incredulous of the fact, he placed a one thousand dollar bill in his pocket, had himself locked in the safe, and declared that he would give the money to the man that unfastened the door. All the blacksmiths and burglars in the State have been boring and beating at that safe for a week, and the man is in there yet! He has whispered through the key-hole that he will make the reward ten thousand dollars if somebody will only let him out. Fears are entertained that the whole concern will have to be melted down in a blast furnace before he is released, and efforts are to be made to pass in through the keyhole a fire proof jacket, to protect the inventor while the iron is melting. The inventor swears if he once gets out, that he will in future always try the experiment with a rival patentee inside. He says he never thought he should wish, as he does now, that some one would find a weak place in his armour.

Benefits of Laughter.

Probably there is not the remotest corner or little inlet of the minute blood vessels of the body that does not feel some wavelet from the great convulsion produced by hearty laughter shaking the central man. The blood moves more lively —probably its chemical, electric or vital condition is distinctly modified—it conveys a different impression to all the organs of the body, as it visits them on that particular mystic journey, when the man is laughing, from what it does at other times. And thus it is that a good laugh lengthens a man's life by conveying a distinct and additional stimulus to the vital forces. The time may come when physicians, attending more closely than they do now to the innumerable subtle influences which the soul exerts upon its tenement of clay, shall prescribe to a torpid patient, "so many peals of laughter, to be undergone at such and such a time," just as they do that far more objectionable prescription—a pill or an electric or galvanic shock.

THE Kansas correspondent of the Cincinnati *Times* says: "Pictures in the old geographies used to represent the Indian solitary and in a melancholy attitude on a rock, gazing in a sad reflective way upon a train of cars speeding along in the valley below. He seemed weeping to see the steam horse invading his hunting grounds, and overcome with gloomy forebodings as to his future. I saw the lonely Indian at the railroad depot this morning. He was grumbling because the train was a few minutes behind time, and cursed the depot agent in good missionary English because he did not hurry up and check his carpet bag. He looked delighted when he saw the train coming, shook hands with the conductor when it arrived, borrowed a 'chaw terbacker' of a brakesman; and, as the train moved away, I saw him comfortably stretched out on two seats, eating peanuts."

NO LIST OF PATENTEES.

At the time of going to press, the official list of patents for the week ending July 11th had not been received at this office.

It is the first time for many months that the Patent Office has failed to furnish copies, and we hope it will be the last for as many months to come.

That class of our readers who watch for the patentees' column with so much interest will be disappointed this week, but the deficiency will be made up next week, and we shall try to provide against a like disappointment in the future. A description of some of the more useful inventions recently patented will be found in the columns usually devoted to such matters.

Out of Print.

New subscribers have poured in upon us since the commencement of our new volume so much faster than was anticipated that, before we were aware of the fact, Number 1, July 1st, was out of print.

Subscribers who do not preserve their numbers for binding will oblige the publishers by sending to this office any copies of July 1st they can spare, to enable us to supply the missing copy to those who keep their numbers for binding.

EDITORIAL SUMMARY.

R. D. MUNSON is a persistent Yankee, a native of Williston Vermont, who has devoted ten of his four score years to the achievement of making a clock that is more complicatedly ingenious than the Strasbourg time-piece, and vastly more serviceable. It runs eight days, and the dial marks the second, minute, hour, and day, the week, month and year; a thermometer rests against its pendulum, giving the state of temperature; the ball of the pendulum contains a miniature timepiece, which derives its motive power solely from its vibrating position, and keeps accurate time; with this there is a delightful musical apparatus, which plays an air at the end of each hour, and it is piously precontrived so as to play only sacred tunes on Sunday, beginning and ending with the "Doxology." On national holidays, the airs are diversified patriotically with "Yankee Doodle," etc. This wonderful timepiece presents a black walnut front ten feet high, twenty inches wide, and ten deep, and is embellished with profuse scroll work and national designs.

NEAR Springfield, Ill., some days ago, a cyclone, beside doing serious mischief, presented a series of wonderful changes. To the eyes of the spectator it first appeared as a mighty whirlwind, the lower stratum of the air seeming to stand perfectly still. Then there succeeded a circular motion, which every instant increased in velocity, whirling up everything it swooped upon like bits of paper. A cylindrical column of dust took shape, reaching like a gigantic pillar to the sky, and through this immense funnel a stream of smoky cloud appeared to descend. Fence rails were picked up like straws and sent flying through the air. At times a river of fire seemed to empty itself from the moving column, to the unspeakable dismay of those who witnessed it. Several good people very nearly suffered translation after the fashion of Elijah, and saved themselves only by falling prostrate and clinging strongly to permanent support. Curiously enough, the actual damage was quite small, as the pillar of destruction traversed only a short distance.

CARPETS, DUST, AND DISEASE.—*Home and Health* says: An atmosphere impregnated with the dust which has been gathered in carpets and remained there for a considerable length of time is positively unhealthy. The dust after being stagnant for some time, especially in warm weather, presents myriads of animalculæ. To prevent the evil the carpets should be cleaned often. The dust should be thoroughly removed every month. The trouble of taking up, shaking and replacing will be amply repaid, first, in the matter of health, and, secondly, in preserving the carpet. We advise the good housewives—there are many—to make a note of this.

IT is reported that the Cuban rebels are using leather guns, a species of artillery used by Gustavus Adolphus and other European commanders in days gone by. The leather while wet is tightly stretched round a wooden core or mold, in successive jackets, the under one belng allowed to dry before the next is put on. A close and tight coil of good rope or cord completes the tube, the breech being made of hard wood lined with tin. Such guns will fire some twenty rounds before giving way, and they are so light that a man can carry a couple of four inch bore of the principle. They are usually fired from the ground, or from a cart.

THE newest wonder at the West is a soda lake near Rawlings, on the Union Pacific Railroad, several miles in circumference, and capable of supplying 65,000 tuns of soda a year. This genial body of water is fed from countless springs bubbling from a species of granite rocks which includes in its composition a soda feldspar.

A MAN who is lost to honor, and has a corrupt and festering heart, never finds anything worthy in the conduct of his associates; he looks upon every one with a constant peering suspicion.

A BED of green mottled granite, the first ever found in this country, has been discovered on the line of the Adirondack Railroad, New York.

FOR FRUIT STAINS ON NAPKINS, TABLE CLOTHS, ETC.— Pour hot water on the spots; rub in hartshorn, or oxalic acid dissolved in water.

What a Fence should be.

In the excellent work on "Suburban Home Grounds," lately issued, and written by J. F. Scott, appear the following valuable suggestions regarding fence construction, something, the importance of which, in adding to the completeness and general good effect of home surroundings, is generally under-estimated:

We are at a loss how to convey the just ideas of the choice that should be made among the infinite variety of fences in our country without writing an illustrated essay. For country or large suburban grounds it is safe to say, except where hedges are maintained, that that kind of fence is best which is least seen, and best seen through. But in towns our fences must harmonize with the architecture and more elegant finish of the street, and therefore be sufficiently well designed and constructed to be in themselves pleasing objects to the passer by. The great desideratum is to answer this requirement, and at the same time to adopt some design that will least conceal the lawn and other beauties beyond or behind it. Our fences should be, to speak figuratively, transparent. Now what will make a transparent fence is a matter much more difficult to decide than the reader will suppose. Where iron fences can be afforded, it is easy to effect the desired result; but they are so expensive that wood will long coutinue to be the main fence material even in towns. Where something really elegant can be afforded, an architect's services should be called into requisition as much as for the residence design. A fence may be as fine a work of art as any other construction, but the architect ought to bear in mind that it should not unnecessarily conceal the beauty it incloses. Among the less expensive kind of fencing, we will mention a few of the forms generally used. First, and most common of all fences claiming to be ornamental, is the plain picket fence, made of strips set vertically the whole hight of the fence, and from one and a half inches to one inch by three. All picket fences shut out a view of the ground behind them, until one is nearly opposite the pickets, as completely as a tight board fence of the same hight. An old and ornamental form of picket fence is that composed of three horizontal rails, with two equal spaces between; one set of pickets being short, and terminated in points above the middle rail, while every other one rises through the top rail in the same way. This gives double the space between the pickets on the upper half of the fence, where a transparent fence is indispensable. It is the best, and also one of the most expensive of the old forms of wooden fences, and the only kind of fencing that should be tolerated for enclosing ornamental grounds.

Fences formed of horizontal rather than vertical pieces are preferable; and the openings between the bars should be as wide as insurance against animals will permit. A substitute for the old style of picket fences, now much used, is composed of boards sawn so that their openings form ornamental designs. These are adopted from German designs for cheap balconies and veranda guards, for which purpose they are well adapted and beautiful; but for front fences they are even more objectionable than pickets, because they bar more completely the view of what is behind. To unite strength, beauty and "transparency," is the object to be gained. What wooden fences will best do this we must leave to the reader's ingenuity and good sense to decide. Those who build most expensively do not necessarily secure the most tasteful places, and in fencing there is much opportunity to let thought balance money. Some very pretty rod iron fences are made, both vertical and horizontal, which are much cheaper than woven wire or cast iron; but both of the latter, being always at hand or ready made for those who have the means to use them, will probably continue to increase in use. The tasteful forms in which iron fences are generally made, together with their indestructible character, will continue to make them more and more desirable. Were it not for the shameful freedom given to the animals in many town and village streets, such fences might be made so much lower and more open than now, as materially to lessen their cost.

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.

VALUE OF COAL AS FUEL.—An experiment lately tried in this vicinity on bituminous and anthracite coal gave a result 5½ per cent in favor of the former; that is, a pound of bituminous coal evaporated 5½ per cent more water than a pound of anthracite coal. I cannot say for a certainty which kind would be most injurious to a boiler, but if the welding of iron by each kind be a criterion to judge by, then I should conclude that anthracite would be the most injurious.—P. Q.

COPYING INK.—If querist No. 9, in issue of July 1st, will take any good bodied ink, (not writing fluid), and add to it one fourth of its bulk of glycerin, he will have the article he calls for. The glycerin prevents the drying of the ink, and when he has written a page he can take a copy in the way described. After taking copy, take up any remaining ink with a common blotter, turn over the leaf and go on writing, copying each page as he proceeds. The writer has copied in this way for years with perfect satisfaction. If the ink dries too quick, add more glycerin; if too slowly, use less. It is desirable to write an even hand with no very fine or very heavy strokes, as the fine ones may dry too quick, and the heavy ones may blot in copying.—G. P. A.

BALLOON VARNISH.—Answer to H. W., query 2, July 1st.—Melt india-rubber in small pieces, with its weight of boiled linseed oil, and thin it with oil of turpentine.—G. S. R., of Ind.

TO KEEP FLIES FROM HORSES.—Take of green leaves of the shagbark hickory (*Carya Alba*) *quantum suff.*; bruise in hot water, let cool, and strain, and sponge the most exposed parts before the horse leaves the stable. I have found this perfectly effectual in preventing horse flies, common flies, greenheads, and mosquitoes from troubling horses, for three or four hours after application.—J. M. H.

POUNDING OF PISTON.—I was troubled with the noise referred to, and took the piston out, when I found I had keyed the crank wrist box ahead, so that the follower head just touched the cylinder head at one end. I suspect that is the trouble with your querist.—C. E. G., of Conn.

T. J. L., of Mass.—We have given all the information yet received by us, in regard to the saccharate of mercury process for extracting gold. Should anything else of importance be published or communicated, we shall notice it in due order.

J. B., Jr., of Ohio, wants an arrangement of lenses, mirrors, etc., whereby he can see customers coming into the front room, without rising from his seat in the back room. There is a window looking from the back room into the front room, but to reach this, he has to rise and walk across the room. Judging from his description, two small mirrors, set at the proper angles, will effect his purpose. A little experiment will enable him to adjust them.

C. E. G., of Mich.—For what purpose do you wish to put kerosene in your boiler? We are at loss to conceive any reasonable purpose for so doing. As to the question of danger, we believe there is always danger in the use of highly inflammable materials about fire. Be advised—don't do it.

E. W., of L. C.—All things else being equal, two wheels of different weights will roll down the same inclined plane in equal times. No matter how the weight is distributed, provided the wheels are balanced, and not taking into account the resistance of the air.

Y. A. S. C., of Mass.—Bathing in fresh cold water may not only be done every day by persons in good health without injury, but with benefit, provided it is done very quickly and care is taken not to produce a chill. To go in daily for the purpose of swimming, and to remain indefinitely in cold water, regardless of the state of the system, and to incur fatigue in so doing is, in our opinion, a dangerous practice.

C. D., of Ohio.—The shining particles in the minerals you send, appear to be mica, not gold.

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.

APPLICATIONS FOR EXTENSION OF PATENTS.

POWER LOOM FOR WEAVING WIRE CLOTH.—Erastus B. Bigelow, of Boston, Mass., has petitioned for an extension of the above patent. Day of hearing, September 20, 1871.

METALLIC SQUARES.—Samuel Darling, of Providence, R.I., has petitioned for an extension of the above patent. Day of hearing, September 20, 1871.

CORN SHELLER.—Arlow M. Cook, of Chicago, Ill., has petitioned for an extension of the above patent. Day of hearing, September 20, 1871.

STEAM PRESSURE GAGE.—E. G. Allen, of Boston, Mass., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

MACHINE FOR TURNING WOODEN BOXES.—Alexander S. Newton, of Bran. don, Vt., has petitioned for an extension of the above patent. Day of hearing, November 1, 1871.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven yea s of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the nventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

MUNN & CO. 37 Park Row.

Inventions Patented in England by Americans.

June 22 to 26, 1871.

[Compiled from the Commissioners of Patents' Journal.

FURNITURE CASTOR.—J. B. Sargent, New Haven, Conn.
GLASS BLOWER'S MOLD.—S. R. Bowie, New Bedford, Mass.
MACHINE FOR TEARING LEATHER.—E. S. Hidden, Millburn, N. J.
MACHINE FOR TURNING CROPS, ETC.—W. W. Wallace, Pittsburgh, Pa., A Giles, Rugeley, Eng.
ORGAN.—R. Burdett, Chicago, Ill.
PLOW, ETC.—W. S. Pratt, Pittsburgh, Pa., A. Giles, Rugeley, Eng.
PRINTING ON CLOTH, ETC.—J. Peacock, New York city.
SEED SOWER.—W. G. Comstock, East Hartford, Conn.
SEWING MACHINE TREADLE.—L. W. Sapp, Cleveland, Ohio.
SPARK ARRESTER.—J. Smith, T. W. Worsdell, Altoona, Pa.
STEAM ENGINE.—H. W. Adams, Philadelphia, Pa.

Foreign Patents.

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

Queries.

[We present herewith a series of inquiries embracing a variety o 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.—RELATIVE POWER IN BORING AND TURNING.—My query, which you were kind enough to publish, concerning the boring of the sixteen inch cylinder, elicits two answers in your last issue, both of which lose sight of the main question. I want to know why it requires more power to bore a sixteen inch cylinder than it does to turn off a twenty-four inch pulley, the cuts being equal. B. P. G., of Mass., gives me directions for making a tool. I think the tool used equally as good, although not having tried his, I would not assert this positively. I used a boring head 15½ inches diameter, with a cutter placed lengthwise, and sharpened to a point on the combined principle of a side tool and a diamond point. R. H., of Mass., is mistaken in the gear. It was not the feed gear that gave way but the back gear and the fixed gear on the lathe mandrel. I am convinced that there is a principle involved, and that it governs the speed as well as the power. I have found by experience that the speed I run my lathe at, for the turning of a 24 inch pulley is right for the boring of a 10 inch cylinder, and when I get a cylinder over 12 inches in diameter, I have to use a smaller driving pulley on the main shaft. I would like to have these two questions answered: 1st. Why does it require more power to bore a 16 inch cylinder than to turn off a 24 inch pulley, or why will a lathe not bore as large as it will turn—say 24 inches? 2d. Why do we run a lathe as slow to bore a sixteen inch cylinder as to turn off a 24 inch pulley, or why can I not run my lathe as fast on a 24 inch cylinder as a 24 inch pulley?—G. S. R.

2.—CAST STEEL.—What is the best method of decarbonizing cast steel, leaving it soft and tough?—C. B. M.

3.—POLISHING MEERSCHAUM.—Will some one inform me how meerschaum is polished, and what is used to polish it?—A. R.

4.—SEALING FRUIT CANS.—I would like a recipe for a composition or wax for sealing tin fruit cans. The one now in use—beeswax and resin—taints most of the fruits so badly that they have a flavor of soapsuds. The resin utterly spoils blackberries. Our fruit season is now upon us, and anything more suitable than the wax now in use will be thankfully received by all your readers in California.—J. B. H.

5.—TO PREVENT OIL BARRELS FROM LEAKING.—What must we do to prepare barrels in such a manner as to prevent the leaking of oil?—L. & B.

6.—BELTS.—Which is the best side, next to the pulley, to run a leather belt? the flesh side or the hair side?—J. F. M.

7.—ANILINE DYES.—How are aniline dyes prepared? What mordants are used to secure a permanent yellow, blue, brown, pink, or purple? What quantity of albumen is used, and how applied?—W. B.

8.—FINISHING WALNUT WOOD.—Is there any means of filling the pores of walnut wood so as to retain the natural life and luster of that beautiful timber, after being varnished? I find nothing in any work in my possession on the subject which will accomplish it, though I suppose there is something used which will effect the purpose.—H. W. M.

9.—FROST PROOF STORE ROOM.—How can I build a frost proof store room above ground, that will answer all the purposes of a cellar below ground?—W. S. H.

10.—BELTS.—If a belt be placed upon drums, the shaft of one of which is inclined relatively to the other, or as the machinists term it, "out of line," which way will the belt run on the inclined drum, to the higher or lower end?—J. E. G.

11.—MARINE GLUE.—F. L. J., of Ark. (June 24th), tells how to make marine glue, namely, by dissolving shellac and india rubber in ether. I have failed utterly to make marine glue according to his formula. I first tried sulphuric ether, pure, which had been prepared for anæsthetic uses. It acted slightly upon the shellac, but not at all on the rubber. I next tried nitric ether. This dissolved a portion of the shellac, but made no impression upon the rubber. I followed the directions strictly, with the exception of heating the ether, which my druggist said would not do, as the boiling point of ether is only 93°. Will F. L. J. please tell me how to make marine glue?—J. H. P.

12.—H. W. L. wants to know how to deposit copper by the electrotype process upon wood.

13.—STAINING HATS.—How are the best straw hats stained that deep dark color that the manufacturers put on them? How is the stain made?

Recent American and Foreign Patents.

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

INSECT TRAP.—Lyman I. Way, of Annawan, Ill.—A recessed funnel, made of tin or other smooth metal, or material, is provided with a handle, and with a flange or collar, near its bottom or small end. A bag, made of cloth or other suitable flexible material, has its mouth secured to the funnel above the collar, by tying or otherwise, so that it can readily be removed. A recess in the rim of the funnel receives the stalk of the plant when the trap is applied. In this manner the funnel is made to partly surround a plant infested with insects. Upon slightly jarring the plant, the bugs or insects upon its leaves will fall into the funnel and slide down into the bag. When once in the bag, they cannot get out, as, if they crawl up the side of the bag, they cannot reach the projecting end of the funnel. In this manner the trap may be carried from plant to plant, and applied until the bag becomes full, or nearly full. Boiling water is then poured into the funnel, which destroys the insects. The bag is now removed from the funnel, and its contents discharged, when it is replaced, and is ready for a repetition of the operation. In this manner a potato field may, in a short time, be rid of destroying pests. The trap may be applied to cucumber and other vines, as well as to other plants, when infested with similar vermin. The remedy is cheap and simple, and is claimed to be effective.

MACHINE FOR LAYING OUT SASH.—This invention consists in a pair of rods, carrying adjustable cutters, arranged above a table, on which the bars to be laid off are placed to work reciprocally toward and from each other and the table, by the action of a foot lever and a spring, for cutting or marking both sides at once, by pinching the bar between them. The sash bars to be laid out are placed on a table, with one end against a gage, by which they are held in the right position relatively to the cutters in the lengthwise direction, and the cutters, being also adjusted properly from the end of the bar and from each other, are brought up against the sides simultaneously, marking both at once. The treadle is raised, and the bars moved back by a coiled spring. John F. Kikendall, Jr., of Virginia, Ill., is the inventor.

FRAMING JOINTS.—Jonah Newton, of New York city.—This invention relates to a new and improved arrangement of mortises and tenons for framing door sash and other like frames and cabinet work together; and it consists in a semi-circular, or nearly semi-circular mortise and corresponding tenon, the latter made on a greater circle, so as not to fit the curved wall of the mortise in the bottom closely, the mortise being made by a circular tool, against which the piece to be mortised is moved in a right line, or the tool moved to the piece; or the said mortise, being first made in this form by a circular tool, may be modified by cutting the ends down for about half, more or less, of the depth of the mortise, on a straight, oblique line, and fitting the tenon thereto. The invention also consists in providing the mortise on the curved wall, or the partly curved and partly oblique walls, with a tongue, and the tenons with a corresponding groove to receive the tongues. The object of the first part of the invention is to simplify and cheapen the making of the mortise, and to provide an arrangement which will prevent the sagging of the doors when the stiles shrink in width; also, to keep the joints tight at the shoulders of the tenons; and the object of the second part is to provide an arrangement whereby the adhesion of the parts, when locked together, will be greater, and a greater surface and better condition for the adhesion of the glue will be provided in the parts to be glued.

MUSIC LEAF HOLDER.—Achille Extein and Jesse C. Mills, inventors.—This consists of a wire bent to form a blunt loop for insertion between the leaves of the book, and also a spring by which a large number of leaves are bound together, so that the leaves cannot turn and perplex the player. The instrument is provided with a neat handle. We need not say it is also applicable to other than music books.

CORN PLANTER.—This is a new and very practical combination of well known devices, whereby a very compact and, we judge, efficient machine has been secured. It is the invention of Samuel J. Rye, of Bluff Point, Ind., assignor to himself and William C. Rye, of the same place.

HASP LOCK FOR TRUNKS, ETC.—A revolving concentrically slotted locking disk in combination with a cap attached to the hasp plate and a headed pin attached to the stationary plate, are the claims for improvements in the patent of Jacob Fisler and George Crompton, of Jersey City, N. J., by which the inventors secure a very simple, strong, and elegant lock for trunks, etc.

SUPPORT FOR MIRRORS AND PICTURE FRAMES.—Dominikus Hartmann, of Mansfield, Ohio, has invented an improved support for mirrors and pictures, which consists of a bracket provided with two or more movable arms, from which arise yokes, between the arms of which are pivoted the articles to be supported. In this way he is able to support more than one object by a single bracket, and at the same time to attain considerable beauty of design in the support itself.

FEATHER RENOVATOR.—This is an apparatus for first steaming and cleansing feathers, and then drying them by the introduction of hot air, the feathers being all the while beaten and stirred by revolving arms in a closed chamber. By the use of this machine the feathers are taken from the sack or bed tick, cleansed, dried, and delivered back into the sack or tick without being handled by hand or exposed to the atmosphere, the operation being, it is claimed, performed in the most expeditious and perfect manner. The inventors are Charles E. Barber and William Dean, of Central Village, Conn., assignees to themselves and George Loring, of the same place.

HAY ELEVATOR.—William T. Neil, of Greensborough, Pa.—This is an arrangement of rope pulleys and self locking and unlocking car and car pulley running upon a horizontal rod whereby part of the load is sustained by the rope which effects the propulsion of the car, thus relieving other parts of strain usually sustained by them.

GRIPERS FOR CYLINDER PRINTING PRESSES.—Victor E. Mauger, of New York city.—The cylinders of printing presses are provided with gripers for holding the paper during the process of printing. Where one cylinder receives the sheets of paper alternately from opposite sides to carry them in opposite directions over the printing bed, it must be provided with two sets of gripers. The object of the present invention is to provide the cylinders of such two feeder presses with adjustable gripers, so that sheets of suitable lengths can be held therein. The invention consists in the use of radial spring gripers guided in movable tubes, which can be set in the perforated cylinder, so that one set will be a suitable distance from the other set of gripers. A set of cams on the stationary central shaft serves to move the radial gripers for opening and closing the same. By this invention two feeder cylinder presses can be adapted for use on sheets of suitable sizes, whereby the scope of their usefulness and their consequent value will be greatly increased.

CANAL LOCKS.—John W. Gentry and George W. Barcus, of Peytona, West Virginia.—This invention consists in an arrangement of snubbing posts or rods in recesses of the walls of the locks, whereby the snubbing ropes may rise and fall on them with the boat in a manner by which the boat may be controlled much better, and the wear of the ropes will be less, than in the use of the snubbing posts arranged on the top of the wall, as in the common way. Long rods or posts are used for the snubbing ropes, so that they may rise and fall on the said posts or rods with the boat, and thereby avoid the tilting and swinging necessarily due to the irregular action of the snubbing rope when working over the upper edge of the wall upon posts at the top, which has a tendency to tilt the boat when lowering, and prevents, by the friction of the rope on the wall, the tightening up of the ropes sufficiently when rising, and in either case wears the ropes away very fast. The rods are supported at the ends in metal plates, or in any other suitable supports, and extend either to the bottom of the lock or to low water mark, or thereabout, as may be preferred.

DOOR FASTENER.—J. A. Morris, of Greenbush, N. Y.—The object of this invention is to provide simple and efficient means for fastening doors on the inside, and which shall be a safeguard to travelers and others in rooms where locks are lacking or out of order. It consists in a jointed plate with spurs for entering the door casing, and with a head and thumb screw for securing the door, which may be carried in the pocket, and which is claimed to be especially valuable for travellers in all circumstances, as ordinary locks are, at best but a poor protection to the lodger.

METHOD OF DRAWING PATTERNS FOR FLARING VESSELS.—Orlando B. Vandenburg, of Findlay, Ohio, has invented a new method of drawing patterns for cutting sheet metal, the object of which is to provide a convenient and reliable system of laying out on sheet metal the necessary lines, so that the metal may be cut to be bent into truncated cones. A diagram only can give a proper conception of the method employed, which is simple and easily applied.

DEVICE FOR FASTENING HANDLES TO SATCHELS, ETC.—Morris Schwerin, Newark, N. J.—This invention relates to a new and useful device for fastening the handles of satchels and travelling bags, valises, trunks, etc. It consists in a flanged cup and flanged tube riveted together, and in a spring clasp around the cup, which clasp is fastened to the bag, trunk, or other article. The fastening thus consists of three pieces, each of which is struck up from a single piece of sheet metal. This fastening is strong and durable, and, it is claimed, costs much less than those now in use. The common fastening for this purpose is made from solid cast metal, and the flanges are made by turning in a lathe and by a screw at the end of the cup. The handle is fastened in the cup by a rivet, the same as in the present device. This fastening is very objectionable, as the screw is very liable to work out, thus rendering it useless.

BREECH LOADING FIREARMS.—This invention consists in a novel and simple arrangement of a locking bar and connecting link with the breech pin and actuating lever for locking the breech pin and working it; also in a novel ejecting apparatus for throwing out the cartridge shell when the breech pin is moved back, said apparatus being set in motion by the breech pin in its backward movement. It also consists in the arrangement of a cover and spring, in connection with an aperture in the side of the stock, whereby the cover is caused to close after the first cartridge has been put in by the said cartridge being forced against it by the magazine spring. George R. Stetson, of New Haven, Conn., is the inventor.

BOOT AND SHOE TAPS.—John C. Hancock, of Charlestown, and Josiah C. Richardson and Edward P. Richardson, of Somerville, Mass.—The inventors employ a thin plate of metal between two plates of india rubber, securing it by making the rubber pieces broader than the metal and uniting the over lapping margins. The bottom plate of rubber will be thicker than the upper one, as it is subjected to the greatest wear. The metal plate will preferably have numerous large perforations in the central part, so that the two plates of rubber may be connected through them, for uniting them more permanently and preventing any looseness of the rubber on the metal between the margins. These metal plates are provided with a row of screw holes, near the edges, for fastening the taps to the soles, and they are intended mainly for holding the screw heads better than the rubber, which is liable to tear and stretch and become loose. Both sole and heel taps are made in this way. These taps possess the principal advantages of india rubber shoes, without being so heavy or clumsy, or interfering with the circulation by cramping and binding the feet. They keep the feet warm and dry, prevent slipping on the ice, are noiseless, easy, light, elastic, and do not detract from the dressy appearance of the boot or shoe.

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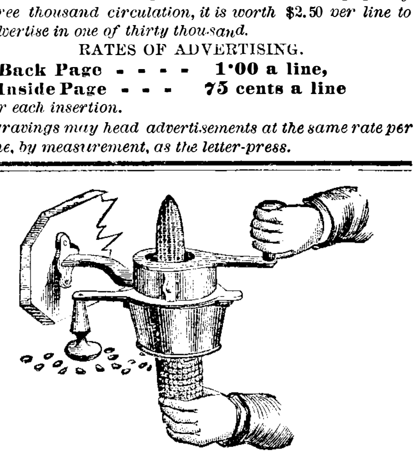

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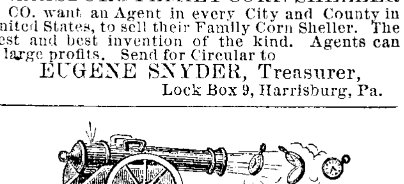

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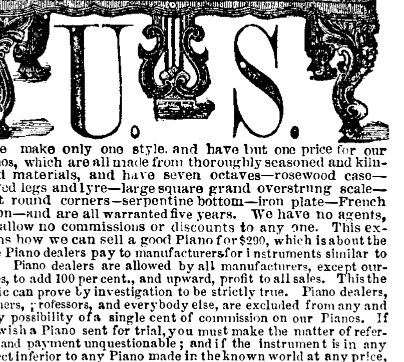

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By the authority of the Board of Directors of THE NEW YORK RAILWAY COMPANY, and in conformity with the terms of the Act of Incorporation in that respect, the undersigned, Commissioners on Stock Subscriptions, give public notice for and on behalf of the Directors, and of such Company, that Books of Subscription for the Capital Stock thereof, will be opened on WEDNESDAY, THE TWENTY-EIGHTH DAY OF JUNE instant, at the following places in this city, viz:—

At the Banking House of
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No. 11 Nassau street.
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Scrip for interest, at the rate of seven per cent per annum, will be issued by the Company, payable out of the first earnings of the Railway, on all installments paid on Stock subscribed for within thirty days after the Subscription Books shall be opened.

The Company reserves the right to close the Subscription Books at any time after the twenty-ninth day of July, 1871.

By order of the Board of Directors.

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John Jacob Astor, Commissioners on behalf of the Company.
Levi P. Morton,

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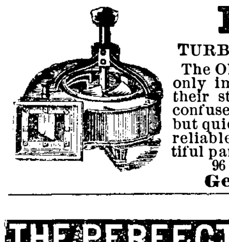

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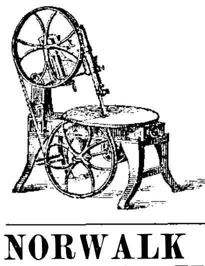

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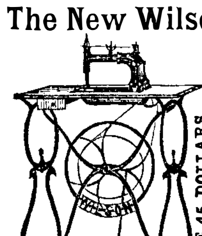

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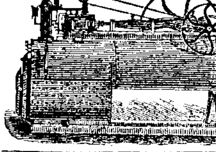

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