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THE FRERE FOUNTAIN, BOMBAY, INDIA.

Our first page illustration, this week, is a view of one of those rare works which captivate the artistic eye, and serve to cultivate a taste for art in the masses. The engraving itself is a work of art that will well repay study. One almost hears the music of the cooling waters, and on these sultry days longs to lave himself in their transparent depths.

The engraving is an excellent representation of the Frere Fountain in Bombay, the largest work of its kind in India, lately erected by the municipality of Bombay as a testimonial of the esteem in which their late Governor, Sir Bartle Frere, is regarded by that presidency. The idea was originated by a native gentleman, Mr. Cursetjee Furdanjee, who gave a liberal donation towards its erection. The hight of the fountain, measured from the water line, is about 35 feet, and it stands in a large basin, 100 feet in diameter, surrounded by an ornamental iron railing, having lamps at intervals. The material is Portland stone, excepting the columns at the base, which are red and gray granites.

The four sitting figures are considerably over life size, and are representations of four of the leading products of India, while that on the top is a representation of Flora. In addition to these there is also a series of four dolphins, from which are discharged fan-like jets of water into shells; the waste water then escapes through the serrations of the shells into basins below, and is further utilized for the supply of jets lower down. In addition to the figures and ornamental sculpture, the fountain is further enriched by bronze heads of lions and panthers. From these heads are discharged jets of water, which fall into the large outer basin. All these jets, however, are subordinate to that in the center; this wells up like a natural spring, the sound of which must be refreshing in a hot climate like that of Bombay.

The execution of this fountain, which has cost about £4,000, exclusive of foundations, large outer basin, waterworks, lamps, ornamental railing, freight, and fixing, was intrusted to Mr. Forsyth, of London, who was already known for his works in this department of art, and who, with the friendly cooperation of Mr. R. Norman Shaw, architect, has carried it out in a successful manner. The site chosen for its erection is the Esplanade, the most salient and central position of the European quarter of the city.

THE FRERE FOUNTAIN BOMBAY, INDIA

WRITERS ON SCIENCE.

At the recent dinner of the Royal Literary Fund, Sir Henry Anderson proposed the toast of "Writers on Science," We make the following extracts, from the reply by Dr. Richardson, from the report of the Society:

Who are the writers on science? Are they as well known as other great writers? They are not. They are less fortunate, and, therefore, the more worthy of the exceptional honor you would bestow on them. Excuse me a moment or two while I indicate the peculiarities of the position of the writer on science. He is a man communicating to the world that which is, by comparison, new to the world. The poet can cast back for his models to a time when the Greeks had not so much as the figment of an alphabet. The theologian may go back for his lesson to the earliest manifestations of the life of intellect on the planet. The historian finds subject and matter ready for his hand from the oldest and remotest, as well as the newest, writings and traditions of races and peoples. The story teller is embarrassed with the richness of the past, and troubled by the greed of his admirers for more of his work. These all, indeed, are but the continuing interpreters of things, events, thoughts, which every man who claims to read, claims also to understand. The writer on science has none of these advantages; he is but newly born into an old world of thought, and is not simply telling of new wonders, but is often himself learning, at the same time as he is instructing an audience unlearned in his knowledge. Thus he comes slowly into the recognized brotherhood of men of letters; at the best he speaks to but a small audience, amuses rarely, excites sometimes, without intention, hopes that are delusive, and requires always, in order that he may be fairly understood, a degree of patience it is vain to expect from the multitude. To these difficulties others are added belonging to the work he accomplishes. The most original writers on science are destroyed constantly by the magnitude and overpowering character of the work they have written, and by the practical results that spring from the work. In other literature the book produced lives as the book, and the learner from it, age after age, must go back to the fountain head to drink and drink; in science literature the book sinks into the fact it proclaims, and the fact remains the exclusive master of the field. A striking example of this flashes across my mind at the present moment. Every reading

man and woman knows that in the reign of Queen Elizabeth the book of Shakspeare's had its origin, and nearly every one who has read the book (and who has not?) remembers the curious saying in it, "I'll put a girdle round the world in forty minutes." But how many are there who have read another great book of that same reign, entitled "*De Magnete*;" or are aware that at the time when Shakespeare was writing his now familiar phrases, the author of the book on the magnet, the Queen's physician, one William Gilbert, when his daily toils of waiting upon the sick were over, was working with his smith in the laboratory at his furnace, needle, and compass, was writing up for the first time the word "Electricity," and was actually forging the beginnings of the very instruments that now, in less than forty seconds, put the girdle round the globe? Again, writers on science are lost sometimes in the blaze of their own success. They raise wonder by what they do, and fall beneath it. All knowledge newly born is miracle, but by and by, as the knowledge becomes familiar, the miracle ceases. In this way advances in science become part of our lives, while the men who write them down cease to us.

When the Leyden jar was first described, Europe was mentally as well as physically convulsed with the thing; now a Leyden jar is a common object—we all know it; but how few know of Mr. Cuneus, who first described this instrument of science? The whole civilized world is cognizant in this day that communication from one part of the world to the other, by telegraph, is almost child's play; but how many have seen or heard of Mr. Cavallo's original "Essay on Electricity" as a means of communicating intelligence to places distant from each other? There is nothing more commonplace, in our day, than to know that a living human being can be placed in gentle sleep, and, while in blissful oblivion, can have performed on him what were once the tortures of the surgeon's art; but how few have heard or seen Sir Humphry Davy's paper announcing to mankind this grand beneficence! These are some of the difficulties of writers on science; and yet there is another I must name, be it ever so lightly. I refer to the desperate struggles of the man of science who has nothing but science to carry him on in life. None but such as are placed as I am, practising as physicians in the metropolis of the world, and admitted at the same time, as men of science, into some knowledge of the subject upon which I now speak, can form a conception of the almost hopelessness of the position of the pure scholar of science. On this I say no more. I would awaken but not weary your sympathy . . . . much of the difficulty these writers have had to bear I recognize with admiration, as their truest glory; and I see that hope for better worldly prospects is near. A profession of science is no doubt organizing. The world is at last asking men of science to employ themselves in teaching the world: and the teachers, bending to the labor, are, in their turn, willing to suspect that they are but as children, or at best youths, in the race after knowledge. This is most hopeful; and it is hopeful also to find that men who claim to be conservators of a knowledge that was matured when science was unborn, are listening now to our scholars with an attentive ear, and are beginning to accept that the Lord of Nature, whether He reveal Himself to the ancient law-giver in the burning bush that was not consumed, or to the modern astronomer in the burning glory of the omnipotent sun, is one and the same Lord. Thus there is hope, I may say certainty, in the future for the literature of science; for its poetry, its parables, its facts, nay, even for its religion.

UTILITY OF PATENT LAWS.

Mr. Macfie, a member of the British Parliament and of the House of Commons Committee on Patent Law, is very much opposed to the grant of patents for new inventions. He is reported to have said among other things, in support of his proposition to repeal the British Patent Law, that a strong movement was being made in the United States to abrogate our patent laws.

We beg to inform Mr. Macfie and the members of Parliament that this statement is not correct. No such movement is being made here. On the contrary, the people of this country were never more fully satisfied as to the advantages of the patent laws than at present.

Our patent laws have contributed in so marked a degree to the prosperity of the country, that the idea of their abandonment finds no place except in the minds of a few erratic, unbalanced individuals, who make it a point to disagree with everything that other people approve.

The House of Commons Committee has been taking the testimony of experts in reference to the general value and results of the British Patent Laws, and among the recent witnesses was Mr. Henry Bessemer, who gave the following interesting evidence, in which a history of his famous improvements in iron and steel manufacture is given.

He said that about seventeen years ago his attention was drawn to the desirability of making improvements in the manufacture of iron; for eighteen months he worked unsuccessfully in the endeavor to make improvements, and then the idea struck him that it might be possible to make cast iron malleable by introducing air into the fluid metal. He accordingly made experiments which proved to him that the highest temperature ever known in the arts could be obtained by the introduction of air into molten cast iron; these additional experiments occupied five months more of his time. In carrying out all these experiments his attention was diverted from his own pursuits for two or two and a half years, and his expenses over the work amounted to six or seven thousand pounds. Mr. George Rennie came to see his experimental works in London, and was so struck by what he saw that he recommended him to bring the invention before the public immediately. He said that whatever the deficiencies of the invention might be in detail, directly the practical ironmaster saw the plan he would fill in the details. He (Mr. Bessemer) accordingly read his paper on the subject at the British Association four days later, the result being that great interest was excited, and several ironmasters visited him in London. He then acted upon the following plan:—He divided England into five districts, and he said he wished one ironmaster in each district to work with him, and not against him. On condition that the ironmaster agreed to do so, the said ironmaster was to pay him a royalty during the first year, but no other royalty during the fourteen years of the protection by patent. Hence each of these five would be very strongly interested in the maintenance of his patent.

His proposition was accepted, and within a very few weeks after the reading of his paper, licenses were taken out amounting to £30,000. The writers in the press did not believe that he could melt malleable iron rapidly, and as several of the ironmasters who carried out his plans faithfully were unsuccessful in their attempts to manufacture, everybody began to run him down. He found that there was a difficulty, so set to work with the capital he had acquired to overcome the difficulty. His experiments were not small ones on the laboratory scale, for he worked from half a tun to two and a half tuns of metal at a time; and in working thus for two and a half years, spent about £16,000. Then he succeeded in overcoming the difficulty, also how to make steel as well as malleable iron; the steel was of so good a quality that in the workshops it could not be distinguished from high class Sheffield metal. He announced these results, but in the press everybody ran the invention down, and nobody believed in it. Had he not been supported by capital his experiments would never have been carried out, and no one of the five ironmasters who allied themselves with him at first made any attempt to get over the first difficulties; they looked upon him simply as a meteor in the metallurgical world.

After he perfected the invention neither ironmasters nor steel makers would take it up. When the case seemed hopeless, he joined two gentlemen at Manchester, and between them they erected works at Sheffield to show people that the invention was a reality. When they first began to sell they had orders for 28 and 56 pounds of steel at a time, but soon the demand began to grow larger, and then the manufacturers began to find that they were being undersold at £20 a ton. Sir John Brown was then erecting great works at Sheffield for the manufacture of steel; he came to see the new process at work, then altered all his plans, and took out licenses to work the process on payment of a royalty of £2 per tun. When he came before the public with his first invention he had asked a royalty only of £2 per tun. The effect of his invention upon the iron trade was that railway tires, which once cost £90 per tun, now cost but £20 per tun, and steel of all kinds and for all purposes had been very greatly reduced in price, therefore he thought that a royalty of £2 per tun was not too much. In this way the business progressed, and he had not only introduced this method of making steel into this country, but it was extensively worked on the Continent, in America, and in India.

HOW PATENT LAWS DEVELOPE IMPROVEMENTS.

If there had been no patent law to fall back upon, he could not have given the time and work to the invention which was found to be necessary, and when the first failure took place all the world was against him. The general results of the invention were that steel had been reduced from £50 or £60 per tun to £20.

Without the patent law, he, as an engineer, should not have gone into the iron trade, with which trade he was originally in no way connected, but with the protection of the patent law he felt no hesitation in making experiments; and when he recouped himself with £30,000, in spite of the adverse opinions of the trade, he still further perfected the invention. He had taken out twenty-six patents in all. The great invention was the forcing of atmospheric air in an upward direction through molten iron; that invention would have been practically valueless, without the after patents relating to improvements in machinery. If somebody else had patented the invention, both inventors would very properly have retained their rights to the special parts of the invention made by each. In cases where good processes result from the union of two inventors, arrangements are sure to be made between the patentees or with the licensees; the self interest of manufacturers and patentees guarantees this.

If a man takes out a patent for an invention which he believes to be of great public utility, one of the public ought to be made to show that it is not so before the right of the patentee should be allowed to cease. Many inventions cannot be introduced at once, as they require the expenditure of large sums of money to try them. Perhaps those who patent trivial inventions might be bound down to introduce them within a given time, but this should not be done when a man patents a machine the construction of which will cost some thousands of pounds. If an inventor did not put his invention in practice within a given time, others might be permitted to do it; a manufacturer might set it going if he had the power of using the invention for nothing; he should then be allowed to use it, because he showed its practicability; but the inventor should have his claim upon anybody who might intend to use it afterwards.

So far as his own invention was concerned he thought that no profit was made out of it till five or six years after the date of the patent. If the law had given him only two years to carry out his plans the world would never have had the benefit of his inventions, and he himself would have lost all his capital. He thought that patents should be granted for improvements in small articles, because in the production of the smallest article, a man having protection will erect valuable machinery to make small things in great quantity at the lowest possible cost, whereby the public gain an advantage which they never had before. Manufacturers, as a rule, are slow in making or taking up inventions.

He had proposed many things to manufacturers which he was convinced would prove useful if worked out, yet he didn't know of one case in which his suggestions had been tried; if he had given time himself to work out the ideas, he should then have to force the invention on the manufacturers, the public would get the benefit, and then other manufacturers would be obliged to follow, just like sheep when one leads the way. A manufacturer may make improvements which effect great changes in the ordinary system. He says: "I have expended much capital on my machinery, my patterns are very valuable, and I do not want to introduce anything new." The difficulty is always to get the first man to try the practical value of an invention. After he completed his invention he paid the five ironmasters, with whom he made his first agreements, to cancel them; to one of them he paid £10,000, and to the Dowlais Company he paid £20,000; by these means he swept the market of all special privileges; some of these manufacturers could have gained £40,000 a year had they kept the original privileges.

The Chairman: I am told that there is an originality about your invention which is rarely found, and that in many inventions there is not the character of individuality. Do you think that in minor inventions there is an individuality differing in degree, but the same in kind, as in great inventions like yours?

Mr. Bessemer said that there was an originality in the idea of forcing air through iron, but that would have been of no use without the addition of many little engineering contrivances; the original invention would have been valueless to the world without means for practically carrying it out. Seven years ago M. Schneider came over from France to him for a license to use the process; he furnished him with drawings and information, but after the lapse of two years he did nothing. At the end of that time he asked to be supplied with additional plans on a great scale; accordingly he sent M. Schneider an entire set of new plans with all the recent improvements; thirteen large sheets of drawings were executed for him. He charged a fixed price per tun on all iron made, as he said, but nothing for plans. M. Schneider then sent his foreman to his (Mr. Bessemer's) works; the foreman also inspected several other works. Time passed away, still M. Schneider did not put up his works. About fourteen months before the chief French patent expired, M. Schneider finished some large works made from his plans, and did not use them; but the day after the patent expired he set enormous works to work. On another patent for machinery he charged M. Schneider a royalty of 2s. 6d. per tun, and an action at law about the payment of that royalty is now pending. He had consequently not received a farthing from France, as all the other manufacturers were following suit, and waiting to see the result of the suit.

He thought that it was impossible to draw a line of demarcation between ideas which were really new and those which result in modifications of known inventions. Manufacturers make small improvements in their machinery and processes, but people not connected with a particular business make nearly all the great inventions of the age, because their minds are so free and untrammelled by custom. If he had been an ironmaster, he felt sure that he should never have made his invention.

SECRET MANUFACTURES HINDER IMPROVEMENTS.

In reference to the question of secret manufacture, for years he had been a secret manufacturer. He had been taught that patent law was so insecure that it could not be trusted. He had also made an invention whereby bronze powder could be produced at very considerably less than its cost in the market, and when he proved many years ago that he could do this, a gentleman gave him £10,000 to float the invention. He made out drawings of the different parts of the machinery he wanted, and had these parts made by manufacturers residing in different parts of the country; he set the process to work, and paid his managers several hundreds of pounds a year to do work worth not more than a payment of £100 a year, but on condition that they should keep the secret. The secret had been kept to that day, and he was nearly the only person who knew it. He had carried on this secret manufacture for twenty-eight years, and was then making three hundred per cent profit by it; when he first began he made a profit of a thousand per cent. But because it had been kept secret it was a manufacture in which no improvement had been made for twenty-eight years, which would not have been the case, he thought, had it been patented, and its details thereby made known. Five machines were required in the operations, and three of these were applicable to other purposes. Once he thought of making a part of the invention public, for use in the color manufacture, in which they would prove valuable; thus by secret processes stagnation is produced. Bronze powder is much used in japanning and gold printing.

His father had also been the worker of a secret process. His father discovered that the "color-water" used by jewelers contained much gold. This color-water was a solution of alum, salt, and saltpetre, which dissolves copper, and some gold. The gold of commerce is always alloyed with copper, and colored gold is a purely gold surface. His father bought up the color-water, and obtained from it a very large quantity of gold, so that in this matter he proved himself a veritable alchemist. The process died with his father, and he had but a hazy recollection of its nature, but his father used to deposit the gold on the large surface presented by

shavings of another metal, then he melted the metal to obtain the gold. He believed that it was essentially an electrogilding process, and if it had not been kept secret very likely Elkington's beautiful process of depositing gold would have been brought before the world thirty years sooner than was actually the case. His father also had a secret method of making printing types.

ON THE WORKING OF PATENTS.

If an inventor failed to carry out any invention he had patented, he thought that a manufacturer, after giving due notice, should have power to start it, but not that any other manufacturer should afterwards have the power to use the same thing without the consent of the patentee. Mr. Bessemer, (in answer to questions put by Mr. Macfie), continued that, although he had acted equitably in charging the same royalty to different manufacturers, it was probable that all patentees might not do the same; in fact, to act fairly to all of them, he had bought up the old licenses at 10s. per ton, when he raised the royalty to £2 per tun. He did not approve of compulsory licenses, because he thought that it was a purely commercial question between the owner of property and the man who desires to purchase. If the owner asks absurd terms he will simply find no customer; he must make it to the interest of a manufacturer to take up his invention rather than to go on on the old plan. He thought that it was very rarely that licenses were refused, and when they were refused, the grounds were probably such that everybody would agree that they ought to have been refused under the circumstances. Once he had refused a license unless a certain condition were complied with. A firm of ironmongers employed an agent to search through his patents, with a view to upset his patent rights; this agent had since very candidly told him that he had told his employers that they had not a leg to stand upon. The company then applied for a license, but he refused it unless one of their people wrote him an apology, not necessarily a humiliating one, for all the abuse and scurrilous misrepresentations which one of them had showered upon him in print. He had a gentlemanly apology at once and the company took out a license, but never used it.

Mr. Macfie: Didn't Mr. Mushet make an invention very like yours?

Mr. Bessemer said that none of Mr. Mushet's inventions were in any degree analagous to his own. Mr. Mushet thought that as manganese much improved Sheffield steel, it might also perhaps much improve the Bessemer steel; in fact, it was analogous to the question whether or no salt improved roast beef, after the beef was prepared and cooked. Mr. Mushet took out no less than twenty-seven patents upon this subject, but never attempted to enter into litigation with him on the subject of the manufacture of steel. Mr. Mushet gave up his patents; they are a nullity to the present day, and he never paid the three years' royalty on them. He (Mr. Bessemer) charged the same royalty in foreign countries to those who worked his foreign patents, and he had taken out patents in France, Belgium, Sweden, Austria, and the United States, in all of which countries he charged a royalty of £2 per tun. He did not take out one in Prussia.

OPERATIONS OF THE PRUSSIAN PATENT OFFICE.

He sent his papers to Prussia in the care of Mr. Krupp, who paid him £5,000 for the use of his patents. He applied in due course for a patent, and was informed by the Prussian Patent Office that the invention was not new. The Prussian Patent Office grants occasional patents; they take the fees and the drawings from British inventors in any case, and afterwards publish them for the benefit of Prussia. The office said that Mr. Nasmyth was the inventor of the process; Mr. Nasmyth said that he was not. They next said that they would give the name of the real man in a few days. Six weeks passed, and they said, "if we don't find the name of the real man to-morrow we will give you the patent." A week of these "to-morrows" passed, after which they showed an English blue-book with his own invention published in it, and they said, "your invention is published, so according to the law of Prussia we cannot grant you a patent." All the time they had been promising to grant it. The process is now worked very largely in Prussia. He thought that it was a custom at Berlin to hold out the prospect of granting a patent to get all the information they can from the English inventor, and then they tell him that his invention is not new. Mr. Krupp has taken out an immense number of patents.

He (Mr. Bessemer), believed that he received the full amount of his royalties from continental manufacturers; he had one agent there only, and he lived in Paris; he had never kept more than two clerks, and these, with himself and partner, did all the work of attending to his business in connection with the manufacture of steel and iron. The patentee has the power by the English law of stopping the importation of articles made without his consent by persons using h's invention in foreign countries. Large as the royalty of £2 might seem to be, it does not interfere with the manufacture or with commercial arrangements at all. The steel which he sold at £15 per tun was the same, so far as he could see, as that which Mr. Krupp sold at £130 per tun; he had tested the two by bending, specific gravity, and everything else, and could find no difference between them. Mr. Krupp was one of the greatest manufacturers of Bessemer steel. He did not think that any commission would have awarded him £5 for his original idea, or would have given him half a million of money as a reward for his invention.

Unsuccessful inventors are an unfortunate class, unfitted to struggle with the world in any business whatever, and they ought to have been born with money, instead of talent only. He did not think that, as a whole, the losses of inventors were greater than their profits. In England also we get a great many foreign patents we should hear nothing about for several years, were it not for the security given by the patent law to inventors. Competition in business does not foster invention much, more especially when the expenditure of large sums of money is involved in experiments.

DISCUSSION ON MR. HARDING'S PAPER, ENTITLED "THE APPLICATION OF STEAM TO CANALS," CONCLUDED IN OUR ISSUE OF JULY 15.---NO. 2.

Mr. Dipnall inquired of what material the boat referred to was constructed. He supposed plate iron would be the best, as giving the greatest capacity and the least amount of friction.

Mr. Harding said the boat he had described was simply an old wooden boat adapted to the experiment, but the new boats which were now being built upon this plan were entirely constructed of iron.

Mr. Dipnall said he had no practical knowledge of this subject, but it appeared to him that a self contained motor must be infinitely superior to any of those schemes of ropes or chains, which might get out of order, to say nothing of the various entanglements which might happen with them. If a vessel, with so small a force as had been described, could carry 200 tuns as the speed mentioned, he thought it would be not only a mechanical but a great commercial success. With regard to the mode of getting rid of the wave wash, he was struck with the vertical sides which the front of the vessel presented. It seemed to him that this was so blunt, and presented such a large surface, that there must be a considerable amount of lateral wash. He was not quite satisfied either whether the propeller was sufficiently protected against any such contingency as a sunken anchor, or anything of that kind, which might throw the whole affair out of gear.

Mr. Hancock inquired whether there was any guide for the discharged water along the whole length of the boat.

Mr. Harding said there was not. The sloping channel was only continued a short distance, as shown in the drawing.

Mr. Hancock said he could scarcely agree with Mr. Towle as to the advantages derived from Mr. Main's propeller, with regard to sustaining a greater weight in the barge, unless the laws of liquids had suddenly undergone a change, because the flotation of such a vessel must depend upon her specific gravity; and if there were a small quantity of water brought underneath the bottom of the boat, it must immediately find its way to the surface. Some time ago, he had seen a plan tried of propulsion by means of air, which was exceedingly ingenious, and, at the same time, very simple. There was a false sloping stern to the boat, and the air was forced against this sloping stern, and so sent the boat along with very little disturbance, the pressure required being very slight. The only objection that occurred to him in the one he saw arose from attempting to get too much pressure. The experiment was tried in a very clumsy way, but still a very respectable speed was obtained, and he thought that further experiments would be proved successful.

Mr. Towle said that whenever a heavily laden boat was propelled by steam power, by which the water was thrown from the stern, the vessel invariably sank at the stern from one to two feet; that was a fact which could not be rubbed out. This system remedied that evil, so that there was a clear gain of the depth of water to which the boat otherwise would sink. With regard to the atmospheric plan just mentioned, it occurred to him that if the water moved away so quietly, the boat would move forward also very quietly, and with much less velocity. Mr. Main's boats certainly possessed advantages which he had not seen in any other.

Mr. Harding, in replying to the remarks which had been made, said the propeller was protected by an iron grating across the front (somewhat indistinct on the diagram) which did not interfere with the passage of water, but which would intercept anything large enough to interfere with the working of the screw. With regard to the rope scheme, mentioned by Mr. Newton, he could only say that he had alluded to similar systems several times in the course of the paper, but time did not allow of entering into details with respect to them. It must be remembered that all these methods were open to several objections; they retained the full effect of the bow wave, which, if any degree of speed were attained, would be considerable; and, in addition to the power required for moving the boat, there was the friction and weight of the rope itself, which had to be pulled through the water. Then, again, there was a great difficulty with the locks. If they were to be roped through, there was a great difficulty with the sill, and it had always been found that you not only damaged the sill, but also soon cut the rope or chain. It would be extremely difficult to arrange any system of that kind which should prevent leakage, and not injure the chain or rope. The great advantage of a boat with self contained power was that it could leave the canal at any time and travel on a river or anywhere else without being towed, and at the same speed. Any self contained motor would always possess superiority in this respect over a system of rope or chain traction. Again, if the machinery of a self propelled vessel was defective, that particular boat was alone detained, whereas, let one portion of the rope plan get out of order, and the entire system from one end of the canal to the other is disarranged. The advantage mentioned by Mr. Towle—that of preventing settling at the stern—was of great importance, since in shallow water every inch of draft was of consequence, and one foot settling at the stern meant six inches less draft available for cargo, thus causing a loss of carrying capacity with greater expenditure of motive power. This settling or "squatting" at the stern interfered also with the steering qualities, while the bow propeller in Main's patent did away with all these objectionable features, kept an even keel, and was easily steered. The very thorough papers already mentioned as read a few years ago before the Institute of Civil Engineers, while advocating steam propulsion against horse towage, and propellers in preference to paddle wheels, particularly specified the disadvantages of propellers in respect to these points. On the table was a model of a rotary steam engine, invented by Mr. J. C. Wilson, which he thought would be very well adapted, from the space it would occupy, to canal boats, and he had arranged with the inventor to give it a trial. They also economized the use of the steam, by expanding it into a second cylinder. He reckoned that an engine about three times the diameter of the model on the table would drive a boat carrying 200 tuns of cargo. He had just received a copy of the SCIENTIFIC AMERICAN, the most able paper of its class in America, which, speaking of various modes of propulsion for canal boats which had been tried on the Erie Canal, said this method of Mr. Main's was of all methods the most simple, and seemed most likely to be popular. With regard to the bow section appearing very blunt, it was the ordinary shape of a canal boat, and would, of course, cause a certain wave if propelled through the water by any usual means at a rate of three miles an hour, but the water drawn into the propeller was really collected from a much larger area than that represented by the size of the channel, which had the effect of greatly reducing the resistance, and prevented bow waves. With regard to the lateral action of fluids, there might be something of the sort if the boat were stationary, but being in motion, there was no time for any perceptible lateral wave until the boat had passed, and then the water did not have the action on the banks as questioned. This was proved by the fact he had before referred to, that when the boat was heeled over by the wind, the bubbles could be seen rising; but as this did not occur when she was on an even keel, it supported the statement.

Mr. Botly moved a vote of thanks to Mr. Harding for his interesting and instructive paper. He remembered some years ago one of the railway "kings" remarking to him that if railways could get rid of a part of the heavy traffic, they would pay much better dividends.

Mr. Varley seconded the motion, and said he had always been favorably impressed with the idea of propelling boats by taking water in at the bow and expelling it at the stern, from having noticed that this was the method of propulsion employed by the larva of the dragon fly, which, though very bulky, moved with great rapidity through the water by an exactly similar means of propulsion.

The chairman said Mr. Harding had hardly stated the full extent to which traveling by canal and steam power had attained. Mr. Hyde Clarke had referred to the Netherlands, and he would add that even at the present day the large steamers leaving the Thames were accustomed, when the state of the tide was convenient, to enter and go along the canals, and you might see steamers there daily going in each direction at full speed. The method adopted there to prevent injury to the banks by waves, was to plant on each side of the canal rushes and willows, which broke the force of the water. The English canals were in a much better condition now than formerly, for there having been a great increase of traffic, these banks had been put into a better state, and they were now, therefore, well adapted for steam navigation. The form of propeller used by Mr. Main reminded him very much of the first model of the propeller which he ever saw, which was patented by a Mr. Smith, and exhibited in a large room opposite Garraway's, as long ago as 1824 or 1825. The inventor had a model boat moved by clockwork, and a pair of paddle wheels, but at the end of a certain time the wheels were unshipped, and the screw brought into play, when the boat made something like twice the speed. That, he believed, was the first public trial of a screw propeller as compared with wheels, and the form of the screw blades was very similar to the one in the drawing. With regard to the form of bow, there was no doubt that a square bowed boat was the most convenient shape for stowage, and it occasioned less dead weight. It had been found in the Navy that very handsome, sharp pointed bows gave a large amount of dead weight with no flotation power, and, therefore, that build had been discontinued.

The vote of thanks having been passed, the meeting adjourned.

A Chinese Puzzle.

The *Galaxy*, for August, contains, among many other good things, the following ingenious puzzle:

A Chinaman died, leaving his property by will to his three sons, as follows: To Fum-Hum, the eldest, one half thereof; to Nu-Pin, his second son, one third thereof; and to Ding-Bat, his youngest, one ninth thereof. When the property was inventoried, it was found to consist of nothing more or less than seventeen elephants; and it puzzled these three heirs how to divide the property according to the terms of the will without chopping up the seventeen elephants, and thereby seriously impairing their value. Finally they applied to a wise neighbor, Sum-Punk, for advice. Sum Punk had an elephant of his own. He drove it into the yard with the seventeen and said: "Now we will suppose that your father left these eighteen elephants. Fum-Hum, take your half and depart." So Fum-Hum took nine elephants and went his way. "Now, Nu-Pin," said the wise man, "take your third and git." So Nu-Pin took six elephants and traveled. "Now, Ding-Bat," said the wise man, "take your ninth and be gone." So Ding-Bat took two elephants and absquatulated. Then Sum-Punk took his own elephant and drove home again. Query: Was the property divided according to the terms of the will?

Myths.

In an able and humorous review of Edward B. Tylor's book, entitled "Primitive Culture," *Nature*, speaking of myths, says:

Civilized knowledge, as a whole, may be likened to an old canoe, of which no plank nor nail is the same as when she started on her first voyage, and myth to the old timbers and metal which once formed a part of her, but have now been some lost, some metamorphosed into wholly different shapes, some utilized again in the construction of other vessels. We can thus understand how every department of thought has absorbed and assimilated more or less of myth—how myth has absorbed and assimilated more or less of every product of the human intellect. It is, in fact, the non-appreciation of the true place of myth in human knowledge, which has led so many earlier students of mythology astray. One school looked on all mythology as crystallized poetry; another as indurated chronicle; a third as frozen philosophy; a fourth as petrified religion, and so forth—each school doing something towards really making mythology what it believed mythology to be, and all, as a net result, extracting from one of the most vitally interesting investigations a mere *caput mortuum* of doubly distilled platitude, and quintessential commonplace. So long as "mythology" meant simply an acquaintance from without with the Greek and Roman Pantheon, such a result was, perhaps, inevitable. Unfortunately the doctrines of these schools are not even yet by any means universally recognized as being themselves mythic; and many of them are still to be found reproduced in contemporary works of no inconsiderable learning, to supply future students with illustrations of Mr. Tylor's theory of survival. It must be admitted, too, that even the late brilliant achievements of more scientific inquirers still leave a vast field untouched for classification and comparison. Nor is this task an easy one. A myth is always the statement or explanation of a phenomenon, and myths may thus be classified according to the phenomena to which they refer; but first of all "to catch your myth," and then to determine the phenomenon to which it refers, are feats, for the most part, beyond the skill of ordinary students.

An amusing instance of these difficulties is afforded by Mr. Tylor himself. "No legend," he observes, "no allegory, no nursery rhyme, is safe from the hermeneutics of a thorough-going mythologic theorist. Should he, for instance, demand as his property the nursery 'Song of Sixpence," his claim would be easily established; obviously the four-and-twenty blackbirds are the four-and-twenty hours, and the pie that holds them is the underlying earth, covered with the over-arching sky; how true a touch of nature it is that when the pie is opened—that is, when day breaks, the birds begin to sing; the King is the sun, and his counting out his money is pouring out the sunshine, the golden shower of Danae; the Queen is the moon, and her transparent honey the moonlight; the Maid is the 'rosy-fingered' Dawn, who rises before the sun, her master, and hangs out the clouds, his clothes, across the sky; the particular blackbird, who so tragically ends the tale by snipping off her nose, is the hour of sunrise. The time-honored rhyme really wants but one thing to prove it a sun myth, that one thing being a proof by some argument more valid than analogy."

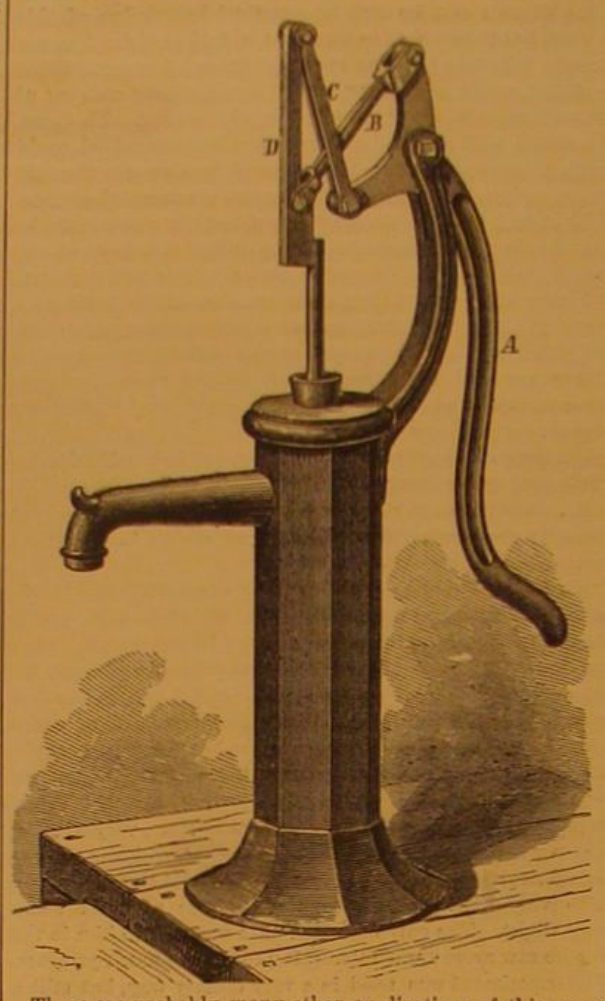
This is exquisitely ingenious; but what if the rhyme should turn out to be, after all, only a quite genuine nursery riddle, of the type which Mr. Tylor has so admirably illustrated elsewhere? An archetypal clock, presented as a *haute nouveauté* to some Edward III. or Richard II., would satisfy all the conditions of the enigma. The large circular face would represent the pie; the four-and-twenty hours duly figured thereon, in accordance with the liberal notions of archaic horology, would correspond to the four-and-twenty blackbirds; the striking, possibly with chimes, to the song of the birds; the king in his counting house, counting out his money, would felicitously symbolize the hour hand counting out the time, which is money, in majestic solitude, unaccompanied as yet by any fussy revolutionary minute hand; the queen in the pantry, eating bread and honey, would typify the stealthy activity of the fine wheel teeth of steel and brass; the maid in the garden, hanging out the clothes, would appropriately allegorize the wooden drum on which the weights were suspended by lines, at a distance from the works; while the magpie, which seems a preferable heading to "blackbird," who snaps off the maid's nose, would probably be none other than the ingenious machinist who wound up the instrument, and, having done so, removed the key from the nozzle of the drum. Whatever may be thought of this interpretation, it seems exceedingly probable that the rhyme is really a riddle, and, indeed, many other unintelligible jingles are most likely referable to the same category. One of them, if a riddle, does also unquestionably enunciate a sun myth. In the immortal "Jack and Jill went up the hill to fetch a pail of water," we may clearly recognize the sun and moon under an enigmatic, not to say riddle-iculous exterior, and after satisfying ourselves as to their identity, we may further admire the curious felicity with which the difference of sex between Hêlios and Selênê—etymologically identical with the difference between *leôs*, a lion, and *leaina*, a lioness—is indicated in the English ditty. To return, however, from the precincts of the nursery, Prof. Max Müller, with a natural bias in the direction of his own brilliant researches, seems to ascribe the origin of myth somewhat too exclusively to the influence of language, just as in his interpretation of myth he appears to pay a rather too marked attention to the Dawn-Goddess to do full justice to the claims of other less seductive divinities. The Professor himself, however, will probably be among the first to recognize the value of Mr. Tylor's distinction between material and verbal myth, and to acquiesce in the classification which considers the former as primary, the latter as secondary in the order of evolution.

NEW MECHANICAL MOVEMENT.

Our engraving illustrates a mechanical movement invented by E. G. Russell, of Ravenna, Ohio, patented through the Scientific American Patent Agency, March 7, 1871.

It converts a circular movement through a limited arc into a rectilinear one, by means of crossed links. The movement is shown as applied to a pump, in which application the inventor assures us it has worked very satisfactorily, but the same principle may be adapted to other machines.

The crossed links, B and C, are shown pivoted to the pump rod, D, and to the arms of the pump handle, A. The same arrangement of crossed links can be duplicated or triplicated if desired, to secure greater strength.



There are probably many other applications of this movement that can be made, such as the actuation of blacksmiths' bellows, organ bellows, and other machines where such a motion is desirable, which will readily suggest themselves to mechanics.

For further particulars, address E. G. RUSSELL, Ravenna, O.

The London "Builder" on Patents.

A patent, says the above named journal, is often a perilous thing, charged with all the plagues of Egypt to its unhappy owner. He has claimed too much, or he has not disclaimed sufficiently; consequently, he may have unwittingly infringed the patent of some other person, of whose existence—patent as well as patentee—he has not the slightest knowledge. As most inventors are sanguine beings, they often fall into this miserable error, nor will the best professional advice at all times enable them to steer clear of this difficulty.

Still, the inventor must be protected; for, if there is any utility in his invention, his property will be stolen from him with impunity; his principle, whatever it may be, will be at once seized upon and applied to daily use by people of whom he has never heard; so that, without something in the form of a patent, protection or privilege, he cannot defend his property, although it is as much his property as an acre of land would be if had bought the freehold.

Before and up to the times of James Watt, the growing depth of the mines had outrun the power of the "fire-engines" then in use to keep them clear from flooding, and had got beyond their power of lifting,—a dead-lock was approaching. Watt hit upon his great invention,—the separate condenser,—that was all, but it was the very soul of the engine, every engine owner in the country could readily add a distinct condenser to his wheezy engine; reap all the advantage of the improvement, pocket all the benefit,—no small one,—and leave Watt without a single penny to reward his ingenuity or the means of recovering a single iota from those who impudently appropriated his improvements.

What benefit could Watt have received for his simple, but nevertheless splendid invention,—none whatever,—without the protection of the law, in the shape of a patent,—no matter in what form,—so long as it secured his rights? Had Watt's patents not been granted, what condition would our mines have been in now? And what would have become of the splendid industry they created?

We have plodded at various times through the dry and dusty papers which have been read before the assembled wisdom of learned societies on this much vexed subject. We have heard lectures on patents and patent laws, and listened eagerly to all sorts and kinds of projected improvements, and we generally left as wise as when we entered. Little or nothing seems to come of all these palavers and speeches; they die a prompt and natural death; and Parliamentary recommendations share the same disastrous fate; and jurors reports from great exhibitions are no exception to the general rule.

Inventors themselves disagree: some advocate the total abrogation of all patents and patent laws,—they stand up for free trade in inventions; others fight manfully in their defence and appear pretty unanimous in the wish to cheapen and make them more easily accessible to the working classes.

Who can decide when doctors disagree? This fierce conflict of opinion,—a healthy sign in itself,—is a tolerably strong proof that some change is required, a remedy for admitted evils; but no inventor has yet invented the happy medium that shall satisfy all parties, or at least the majority for it is hopeless to attempt to satisfy all.

Shad in the Hudson.

The propagation of shad, says the *Rochester Union*, in the Hudson River has been prosecuted under the Commissioners of Fisheries this year with energy and success. The number of young shad brought forth and turned into the river may be counted by millions. The season has now closed. The temperature of the water has risen above eighty, and put an end to the hatching operations. The place selected for operations was Mull's Fishery, some ten miles below Albany. To that place the agents employed with the requisite apparatus repaired and encamped about the middle of May and remained till the 6th of July. Owing to the increase of shad by the work of former years, there was less difficulty in obtaining the parent fish for propagation. The catching of the shad and the manipulation is all done in the night—generally between the hours of nine and two. A large proportion of the shad taken were unripe or unfit for production.

M. A. Green, who has given his personal attention to the operations at Mull's, reports that on the night of May 15 he caught forty shad, of which only three were ripe, and from these he took 60,000 spawn. The temperature of the water ranged from 60° to 68°. On the 20th he took seven ripe shad which produced 140,000 spawn. On several occasions over 300,000 spawn were taken in a single night. On the 5th of July, the water was above 80°, and no shad were taken. Above 240,000 young shad were turned loose, and this closed operations on the Hudson for the season. The total of spawn taken was 8,335,000, from which 7,823,000 shad were produced and turned into the river. Three years from this Spring these shad will be large enough for market, and at that time the catch in the Hudson will be so large that shad will be sold at very low figures. Enough has been done in the way of shad culture on the Hudson in the past two seasons to make a marked difference in the yield in the two succeeding seasons. The practical results of fish culture may now be realized.

Petroleum in New Zealand.

A correspondent forwards us a document from which we extract the following facts concerning petroleum deposits in New Plymouth, New Zealand.

The first observation of coal oil was in the earliest days of the settlement, when a viscous fluid was seen floating on water, left in pools by the retreating tides, on the causeway between the island of Mikotaki and the main land. The appearance was disregarded as unimportant, and it was not till the year 1865 that operations were commenced. Messrs. Carter & Co., a well known firm in New Zealand, began operations at the Alpha well, and, through difficulties from water and gas, and from inefficient appliances, the shaft was sunk to a depth of about 60 feet and then abandoned, as the water became unmanageable. Further attempts were made by boring, and oil was struck at 85 feet from the surface. The well was sold to the Taranaki Petroleum Company, who erected an engine to pump the well. The oil soon began to flow at an increasing rate, but afterwards gave out, and, after an attempt to bore in a better manner, the Alpha well was abandoned. Other and further researches for oil were prosecuted without any encouraging amount of success.

The failure of these proceedings is to be accounted for by the fact that none of the parties engaged had ever seen an oil well, or had witnessed boring operations conducted with proper tools. The presence of oil in quantities has been demonstrated, and if skilled labor can be had, capital will soon be found by the enterprising inhabitants of the thriving colony of New Zealand.

In the neighborhood mentioned by our correspondent, is the far famed Taranaki iron sand, an enormous deposit of granulated iron of the highest purity. In appearance, it resembles fine, glazed gunpowder. We were shown, in London, a few years since, a knife of which the steel was said to be made from this iron; and the edge of the blade withstood the most violent treatment without being turned.

The Oil Business.

Speaking of the progress of Petrolia and the oil interest, the local paper says: At no time for years has there been more activity in oil development in this vicinity than at present. About thirty new wells are now under way, giving employment to one hundred and eighty men, besides the business furnished to teamsters, machinists, and so forth; and we hear reports of other wells soon to be begun. The work spoken of, added to that furnished by the running of pumping wells, accounts for the consumption that supports so many trading establishments as our rising village presents. Besides, the refinery interest here is one of great importance, and adds largely to the weekly circulation of money—a fact distinctly visible on pay night. Altogether the aspect is cheerful, and the prospects improve daily.

CROCKER'S WHIFFLETREE COUPLING.

The annexed engraving illustrates a whiffletree coupling patented through the Scientific American Patent Agency, May 2, 1871, by Hyde Crocker, Jr., of Montrose, Pa.

The evener may be coupled in the same way as the whiffletrees if desired, and is so shown in the engraving.

The coupling is formed of two parts shown in detail at the right and left of the engraving, the one at the right being the part attached to the evener, and the one at the left that attached to the whiffletrees. The part at the left is placed so that its ears extend up through the hole in the part at the right, the latter having a recess to receive the flange in the former. The part shown at the right is then securely bolted to the evener. The whiffletree is then placed between the ears of the part at the left, and secured by riveting. A very firm attachment is thus made.

The inventor does not confine his claim to the use of the ears shown, but forms them so as to embrace the upper surface of the whiffletree, or in any other manner deemed desirable. The parts of this coupling can be made of malleable cast iron, and are therefore cheap as well as efficient. Address the patentee as above for further information.

Iron Paper.

In the Great Exhibition of 1851, an American specimen of iron paper was first exhibited. A lively competition in iron rolling ensued among British iron manufacturers, excited by the above challenge from America, as to the thinness to which steel could be rolled cold. Mr. Gillott rolled sheets the average thickness of which was the 1,800th part of an inch. In other words, 1,800 sheets piled upon each other would collectively measure an inch in thickness, while the thinnest tissue paper to be purchased in the stationers' shops measured the 1,200th part of an inch.

These very thin iron sheets are perfectly smooth and easy to write on, although porous when held up to a good light. It may not be out of place, considering the great interest that is taken by those connected with that great branch of industry, the iron trade, to give a few curious particulars as to what extent iron can be welded, and the thin sheets that can be rolled out. Brother Jonathan little thought what a hubbub would be created in the old country, when from Pittsburgh he sent that wonderful letter, written on a sheet made from iron, which took no less than 1,000 sheets to make one inch in thickness, the dimensions being eight inches by five and a half inches, or a surface of forty-four inches, and weighing sixty-nine grains. This fact had no sooner made its appearance in print than Britain's sons began to work, and soon we heard of that sheet containing the same number of surface inches, but weighing only forty-six grains, had been made at the Marshfield Iron Works, Llanelly, Carmarthenshire, being exactly one third less in weight. But soon the Welsh leek had to give way to the rose of England, for Staffordshire was anxious to take its wonted lead. The Hope Ironworks succeeded in making a sheet of 11 surface inches, weighing but 89 grains, which, reduced to the American and Welsh standard of 44 in., gives about 33 grains; Messrs. R. Williams & Co., 69 in., 49 grains; reduced to the same standard, about 31 grains. For a time, Staffordshire wears the belt, but Wales becomes very restless, and is anxious for the honor of St. David; so further attempts must be made. Marshfield comes again into the field. They succeed in making one sheet, 8 in. by 5½ in., or a surface of 44 in., of the astounding weight of 23½ grains only, which required no less than 2,583 sheets to make one inch in thickness; another sheet, 8 in by 6 in., or 48 surface inches, weighed 25 grains, but brought to the standard of 44 inches, gives but 23 grains, and requires 2,950 sheets to make one inch in thickness. The Pontardawe Tinworks next come into the field with a sheet 14¾ by 7 5/16, or a surface of 115·17 in., weighing 60 grains; but being reduced to 44 in., is 24½ grains—a trifle heavier than the Marshfield, but Pontardawe claims 3,799 sheets to make one inch in thickness.

We now come to the climax. The mill manager of Messrs. W. Hallam & Co., of the Upper Forest Tin Works, near Swansea, has succeeded in making a sheet of the finest appearance and thinness that has ever yet been seen by mortal eye. The iron from which the sheet was rolled was made on the premises. It was worked in a finery with charcoal and the usual blast; afterwards taken to the hammer, to be formed into a regular flat bottom; from thence conveyed to the balling furnace, and when sufficiently heated, taken up to the rolls, lengthened, and cut by shears into the proper lengths, piled up, and transferred to the balling furnace again; when heated, it was passed through the rolls, back again into the balling furnace, and when duly brought to the proper pitch, was taken to the rolls, and made into a thorough good bar. Such is the history in connection with the forge department. It was then taken to the tin mills, and rolled till it was supposed to be thinner than 23 grains, afterward passed through the cold rolls to give it the necessary polish, and now it stands on record as the thinnest sheet of iron ever rolled. The sheet in question is 10 in. by 5½ in., or 55 in. in surface, and weighs but 20 grains, which, being brought to the standard of 8 in. by 5½ in., or 44 surface inches, is but 16 grains, or 30 per cent less than any previous effort, and requires at least 4,800 to make one inch in thickness.—*Ironmonger.*

THE Government of the island of Jamaica has passed laws authorizing aliens to hold real estate, and a large quantity of Government lands is soon to be put on the market at about one dollar an acre. So writes to us, from Kingston, an esteemed correspondent, who holds an official position.

Obituary.

MR. ALEXANDER KEITH JOHNSTON, a well known eminent geographer, died recently in London. His knowledge of the science of geography was universal and complete, and his great learning has been communicated to the world by his published maps and atlases, which have long been renowned for their extraordinary accuracy as well as for beautiful execution. The latter excellence is due to Mr. Johnston's practical acquaintance with the engraver's art, to which he was in early youth apprenticed, and which first drew his attention to geography as a study. His *Physical Atlas of Natural Phenomena*, published in 1848, is the most important and valuable work of its class yet produced. His labors were widely appreciated, he having been elected a corresponding member of all the principal geographical societies of Europe, America, and Asia, and he was a well known and valued Fellow of the Royal Society of England, besides receiving many honors in other branches of science. He was a native of Kirkhill, near Edinburgh, and died in his sixty-seventh year.

BELT HOLES—QUARTER TURNED BELTS.

There has been considerable inquiry upon this subject from new subscribers, and for their benefit we republish the following direction from page 85, Vol. XVIII of the SCIENTIFIC AMERICAN:

The only proper method is by diagrams. Sweep a clean place on a smooth floor and set out with chalk line and "tram" two views of the pulleys and the floor, getting the distances as accurately as possible, or lay them down on paper to a suitable scale. Notice that a belt to work at quarter twist must run *on* to both pulleys in a line parallel with the plane of rotation, as B, in the diagram, running on the lower pulley, or C, running in an opposite direction on the upper

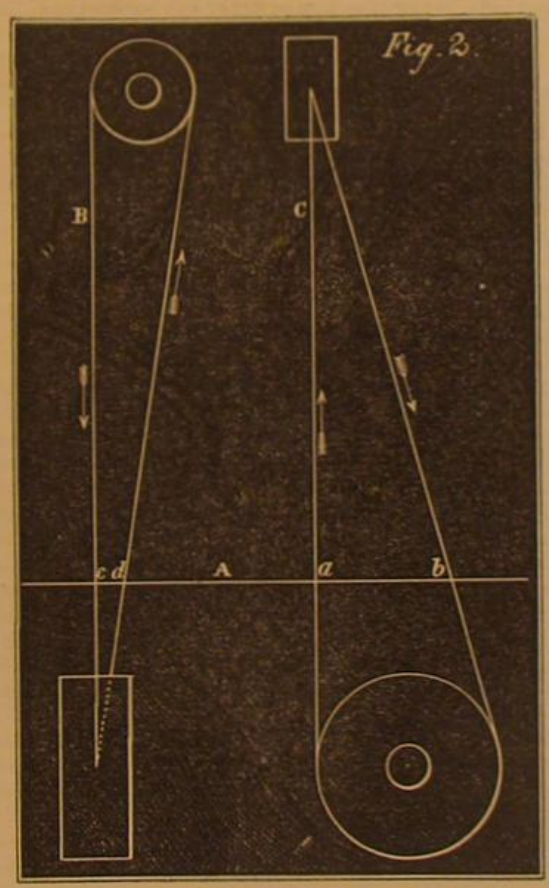


Fig. 2.

one. Therefore drop the perpendiculars, B and C, as shown, and draw the diagonals, giving the distances, *a b* and *c d*, on the floor line, A. Now drop a plumb line from each side of the upper pulley at the center of the face to the floor, and from one point so found, *c*, in the diagram, lay off the distance, *a b*, in a line parallel with the upper shaft, and from the other point, *a*, in the diagram, the distance, *c d*, parallel with the lower shaft; the points so found will be the centers of the belt holes. The twist to be given to the holes, if such a refinement is necessary, may be made a matter of judgment.

The Gas Wells of Pennsylvania.

Honorable Neal Dow Communicates to the Boston *Congregationalist* gives the following account of natural gas wells:

In many parts of the Key Stone State, wells, bored for the purpose, yield an abundant flow of illuminating gas—identical in its character with that manufactured in our cities from bituminous coal. These wells are from two hundred to seven hundred or eight hundred feet deep, and from three inches to five or six inches in diameter. They are "bored" through the various strata of earth and stone, and are lined, like oil wells, with wrought iron pipe made for the purpose. In many places these wells are of great value, affording sufficient fuel for driving the machinery of large manufacturing establishments. In some cases the supply of gas is sufficient to repay the entire cost of the well and fixtures in a single year or less.

At Erie, I saw several of these gas wells employed in this way. Directly on the shore of the lake are located the works for the supply of the city with water. The water is forced into a stand pipe, two hundred and thirty feet high, by which it is distributed with sufficient pressure over the entire city. Two enormous engines do this work, being driven by steam generated by gas flowing from a well sunk upon the premises We were permitted to look into the furnaces, which were all aglow with a brilliant flame, issuing from a series of small pipes connected with the gas well. There was no dust nor smoke, and no fireman was required. The only attention necessary was to turn on or off a little gas according to the indications of the steam gage. The works were about to be enlarged, and another well was in progress, to furnish gas for the additional boilers.

These gas wells are found also in operation for domestic purposes; I saw it employed in a gentleman's house. In the library was an open fireplace, and a wood fire—or what seemed to be such,—for the terra cotta upon the andirons was in admirable imitation of hickory wood. A low fire was burning, for the morning was not cold; the lady of the house turned a small tap near the fireplace, and the flame instantly increased in volume, and continued to increase, as the gas was turned on, until the fireplace was full of flame, issuing from the terra cotta, and we had what seemed to be a roaring hickory wood fire.

The gas was then slowly turned of, and the fire gradually diminished and finally expired. The lady then with a match lighted a piece of paper and threw it upon the wood, turning on the gas at the same moment, and we had instantly the low fire which we found at the beginning. In every room in the house, except the kitchen, was a similar apparatus, and fires could at any moment be lighted with as much facility as the chandeliers in the same apartments, supplied with gas from the same well.

In the kitchen was a large and complete range, sufficient for a family of thirty persons. When we entered, a low fire was burning, and sundry vessels were simmering over the flame. The cook turned a tap, and instantly the range was filled with a fire sufficient for all culinary operations up to the full capacity of the apparatus. Nothing is employed in that house for heating and illumination, except this gas.

The well is in the back yard, sufficiently removed from the mansion, and is covered by a small house. The bore is five hundred and twenty feet deep, lined with iron pipe, and furnished with a safety valve, like that of a steam boiler, and the gas is brought into the house and conducted over it, in the same mode employed in the case of ordinary street gas or water. The entire cost of this well and the fixtures, ready for use, was twenty-five hundred dollars, and the supply of gas was sufficient, I thought, for two or three other first class houses. Nothing can possibly be more perfect than this arrangement; the fuel supply being as convenient and abundant as that of water and illuminating gas from the public works.

REMINISCENCES OF INVENTORS.

Inventors have been occasionally the recipients of Government bounty,—always inadequate. This kind of reward is not only precarious, but apparently doled out on no fixed principle as to the merits of the case or the amount to be granted.

Henry Cort, whose great invention for the manufacture of iron is a well-known case, it is true, received the sum of £20,000, but too late in life for him to reap any enjoyment from it. It has been estimated by competent authority that the application of his discovery has created wealth to the amount of between £600,000,000 and £700,000,000, not a long way removed from equaling the National Debt, and gives at the present time employment to upwards of 600,000 workpeople.

Perhaps one of the most unfortunate inventors was Henry Fourdrinier, who, after the labor of a long life, the ruin of his prospects, and the expenditure of £60,000, brought to perfection his machine for making paper,—one of the most useful machines ever invented for aiding in the spread of knowledge, after the printing press itself. So great was the improvement effected by this beautiful machine that the paper duty was soon increased by upwards of £500,000 per annum, and effected a saving to the country of £8,000,000. From the great improvement of the paper, it assisted powerfully in the progress of lithography and engraving. Even where least expected, it brought improvement in its train, for the fine tissue paper manufactured by it had a marked effect in improving the printing of patterns and devices on pottery, which was felt and freely admitted in Staffordshire. When in extreme old age, after many weary years of application, he received the small and utterly inadequate Government grant of £7,000, after his claims had been carefully investigated by a Parliamentary Committee. He lived to see the triumph of his machines, and died at the patriarchal age of eighty-nine.

Could this noble old man have stood by my side but a few weeks ago, how his eyes would have glistened with pleasure, to look upon some fine brass wove wire of 28,000 meshes to the square inch, and a copper wire 3,000 yards long, drawn from a single penny-piece,—one of Boulton & Watt's old contract pieces, long since withdrawn from circulation. What painful trouble, labor, and anxiety, these fine specimens of wire weaving would have saved to Henry Fourdriner, could he but have had the like when he began his experiments at his once paper mills,—the Two Waters,—at the juncture of the little river Gade and Bulbourne brook, in pleasant Hertfordshire?

Accidentally looking over an old-fashioned description of Derbyshire, "adorned with copper cuts," I stumbled upon a quaint account of Sir Thomas Lombe's once renowned silk-twisting mill, built on the banks of the pretty Derwent at Derby.

The somewhat mystified history of this piece of machinery is well known,—how Lombe went to Italy, got introduced to a famous silk mill there as a workman, studied the details, copied out all its parts, then fled for dear life to England, where he put up his mill,—the first in the kingdom,—for making argazine or thrown silk. So began the silk twist trade. We are treated to a little detail, and told how,—"This engine has 26,586 wheels and 97,746 movements, which are all worked by one water-wheel turned by the Derwent three times round a minute. By every turn of the water wheel the machine twists 73,726 yards of silk; so that in twenty-four hours it will twist 318,496,320 yards. And it gives employment to between 300 and 400 workpeople. This machine was considered of so much importance by the Legislature that, on the expiration of the patent the Parliament granted him £14,000 as a further recompense for the great hazard he ran;" for he is said to have been dogged by Italian assassins.

The condition of the recompense was that a perfect mode of the machine should be sent to the Record Office in the Tower of London, there to be kept to perpetuate the invention. The sole existing fragment of this machine is now preserved in a small glass case in the Patent Museum, Brompton; it is of wood, and seems have been well made, as far as one can judge from so small a fragment.

Harrison, the famous chronometer maker, and inventor of many useful appliances in horology, received a Government grant of £20,000 for improvements effected by him in chronometers and other time-keepers; he well deserved it, for he was a great friend to astronomers and navigators. A curious old fashioned eight-day clock, with wooden wheels, the production of his hands, is preserved in the Patent Museum, Brompton; it still "go's tic-tac," and is well worth inspection.—*London Builder.*

Correspondence.

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

Paine's Motor.

"A man's useful inventions subject him to insult, robbery, and abuse."—FRANKLIN.

To the Editor of the Scientific American:

I was never more favorably impressed with the truth of the old philosopher's remark than with an article in your journal on Paine's motor, over the signature of "Rowland, C. E." Will you permit me, not in defense of Paine, but in the name of common justice, to state that I have constructed a motor (surreptitiously) after the description and drawings of Mr. Paine's English patent, and it fully verifies all his claims. I had previously been familiarly conversant with all the details of his experiments and found my task an easy one.

As no one not essentially an expert in electrical dynamics can explain why success has not heretofore crowned the efforts of the multitude of experimentalists, so no one but such an expert can realize the obstacles overcome, and the value of the results. A technical description of Mr. Paine's engine would possess little interest for the general reader; therefore the general statement that it occupies one tenth the room of a steam engine and boiler of equal power—involves no risk of fire or explosion—can be operated in a drawing room, as regards cleanliness, and at less cost than any steam motor—expresses all that is required by the economist. But to the mind of the physicist—to such men as Doremus, Tyndall, and Henry—an investigation of Mr. Paine's treatment of the electric currents opens up a field of thought second to none in the annals of science.

While witnessing the operation of the motor we cannot fail to be impressed with the perfect unity of mechanical engineering and profound science evinced in its construction.

Take for instance the first element of the machine, the magnet. Oersted had given, to our constructor in common with others, a bar of iron traversed by electrical currents. Ampère's and Henry's observations and manipulations thereof were deemed exhaustive; and later and more practical experimentors, Page and Farmer, certified the impossibility of successful results to be obtained from electro-magnetism as regarded motive power; the former by costly experiments, and the latter by both experiment and scientific deduction.

Mr. Paine, therefore, with any hopes of success, must start from a source as original as Oersted's, and a glance at the construction of the magnet is sufficient to satisfy the expert not only of original thought but of successful application.

As the normal condition of each molecule, in the mass of iron to be magnetized, must be disturbed, it follows that if any portion of the molecules can be removed without detriment to the required polar surface, or action, that a corresponding reduction of battery, and consequently of cost, will ensue.

Imagine a parallelogram bar, twelve inches long, three inches and one half thick, with four inches of its poles wound with insulated wire, and we have the common bar electro-magnet.

Now, Mr. Paine's researches revealed the important fact that more than one third of the molecules in the parallelogram were absorbents of electrical force under conditions adverse to any dynamical value. These battery wasting elements were found resident in the sides of the parallelogram (outside of the curved line starting from one pole and touching the axes of the parallelogram), at its center while being continued to the opposite pole. Remove this mass and we have the ordinary bar electro-magnet converted into Paine's sector magnet.

This improvement relates entirely to the economizing of battery force, and considered alone adds but little to the attainment of a practical electro-motor. For however sensitive the limbs of a magnet may be to the action of a traversing current, so long as the currents are reactionary, one on the other, all hopes of obtaining valuable results from such currents are as futile as to expect value from a wheel whose back water nearly equals its head.

Electricians are aware that like currents are repellent of each other. Now, if the coil of a helix be to the right and the current moving to the right, it follows that each successive layer must be moving in the same direction, and if there be twenty layers there will be eighteen currents moving in the same direction, and reacting on each other, producing the effect on the primary current that back water does on that of the head water in the case of the water wheel.

This destructive induced action is the rock that has wrecked many a hopeful experimentalist. It is one of two obstacles of which electrical scientists have predicated the impossible in electro-motors. But to the patient investigation and persistent efforts of twenty years even this impossibility has given way, the induced currents are neutralized, leaving the primary current free to expend its full value on the limbs of the magnet.

This desirable result is obtained by the interposition, between the layers, of metal foils, the theory being that the damaging induced currents expend themselves on the foil instead of re-acting on the primary current. However correct or otherwise this theory may be, the results as compared with magnets not treated with the foil are most astounding.

The great magnet in the New York College was made by the Messrs. Chester, who, it is needless to remark, have, in its construction, satisfied every requirement know to scientific record. This magnet weighs seven hundred pounds, and when actuated by a battery of three hundred one-gallon cells, disturbs a weight of fifty pounds at a distance of one inch from its poles. Now a Paine magnet weighing fifty pounds, and working under a battery of nine Bunsen's cells of one quart each, has an attractive power of one hundred and four pounds at a distance of one inch and five eighths, a difference in its favor over the college magnet, as regards battery power, of a hundred to one, and of dynamical value of almost eighty to one.

It would seem that possessing magnets of such immense power, at a mere nominal cost, that they only require the skill of the machinist to realize the wildest hopes of the enthusiast.

But just at this point—the application of the magnets to the production of continuous motion—the other insurmountable object intervenes, namely, the reflex action of the currents. Experimenters have found that magnets do not develope the same power when arranged to produce motion, as when tested in an isolated condition.

Magnets that have a dynamic value of ten when isolated, will develope less than two and one half when arranged one with the other, so as to produce rotary or reciprocating motion. All electric engines are operated by one common principle of cutting off the current from the magnet when its duty has been performed, and passing it to the next magnet in advance on the line of motion. Now, at the instant of breaking the current in the first magnet, the whole coil is charged with a current flowing, one will suppose, to the right. At the moment this current is interrupted, the current in the coil reacts to the left, giving the magnet a dynamic value equal to seventy-five per cent of the primary current, and this seventy-five per cent is reacting against the primary current on the magnet in advance.

Many attempts have been made to neutralize this reflex action, but to utilize it, to convert this three fourths of retarding force into assistant power, seems to have been left to the genius of Mr. Paine to accomplish.

It is difficult to explain, without drawings for reference, the details by which this desirable result is obtained. In general terms, the magnets are so arranged with reference to each other, that when one half the stroke is accomplished, the battery current is cut off and the reflex current expends itself in the rest of the stroke; and while the engine is being thus operated by the reflex action, the primary current is on the leading magnet, whose position is the most advantageous to utilize the primary current, and thus the full battery power is economized.

In the construction of the present engine, the immense direct strain of the magnets (a strain equal to twenty tuns) has necessitated the construction of a framework of peculiar and novel character. The fulcrum or stationary magnets have concave poles, and the wheel or rotating magnets are correspondingly convex.

The theoretic value of this arrangement is realized when these surfaces of the poles are worked so nearly in contact as to require lubrication. But the direct strain is so great that no massiveness of structure will secure the magnets from absolute contact, when thus attempted to be operated, and therefore a certain value of the magnetic attraction must be sacrificed to practical requirements.

The magnets in the present motor are adjusted to work at one sixtieth of an inch, and should the frame spring that amount, the engine must stop, as the fulcrum magnets would act as a break on the wheel magnets. Mechanical engineers will understand how difficult a task it has been to devise a frame of the weight, and in the compass, of the one under consideration, that would withstand the impact of twenty tuns without yielding the one sixtieth of an inch, and yet this is most successfully accomplished in the engine under consideration.

Reflecting on the small battery cost required to develope these great forces, it would seem that all that is now required to give the world a costless power, is the discovery of some mechanical process of generating quantity currents of electricity. We have magneto-electric machines that require less than one horse-power to generate an intensity current equal to thirty Bunsen's cells, and, as Mr. Paine's engine develops over three horse-power under three such cells, there would be a large surplus of power after operating the generating battery. But unfortunately, all machine electricity has high intensity with low quantity, and it is the latter quality that is required to give dynamic value to the magnet.

Whether Mr. Paine will overcome this difficulty is yet a question of experiment, but I may add, in view of what he has accomplished, there are strong probabilities of his success. With all these results Mr. Paine's labors are far from complete; there exist certain phenomena which have as yet baffled his powers of investigation. I refer to spasmodic action, irregularity of motion, and the uncertain life of the magnet.

Mr, Paine is now devoting his energies to the investigation of these adverse causes, and it is to be regretted that the spleen of some men and malice of others should, by their outrageous innuendoes, disturb the quiet so much required in researches of this kind. WINFIELD S. SIMS.

Newark, N. J.

The Depths of the Sea---No. 2.

To the Editor of the Scientific American:

The ocean has, like the firm land, its beautiful meadows, its vast forests. Its mountains and valleys are covered by a multitude of various plants, each species requiring its own particular climate, but the contrary one of that which it would choose on the surface of the earth. In ascending a mountain, we see how vegetation decreases gradually as we ascend higher and higher; how it, by and by, gets a sickly appearance, and at last disappears entirely to give way to everlasting snow.

An entirely contrary phenomenon would be observed in the waters of the ocean. The further we descend into the deep dales of the sea, the more does vegetation diminish; and from a depth of 3,000 meters, the plumb line never brought up any particle or trace of any plants; we are therefore entitled to argue that the deepest submarine abysses are totally deprived of vegetation. Land plants do not grow beyond the boundary of snow; so sea plants cannot exist in considerable depths. Some of the sea plants prefer a quiet place, where they are not touched by currents; others attach themselves firmly to rocks or other solid masses, around which a constant whirlpool is roaring and raging. These latter seem to thrive best in the stormiest roaring of the surges. Cane, reed grass, sedge, rush, salt herbs, etc., which require air and light, grow close to the shore or the level of the water; and while their roots are nourished from the shallow bottom of the sea, their branches and blossoms form charming little islands, on which water fowls are building their nests.

In the transparent waters of the Pacific, the vegetation of the sea displays its greatest splendor and richness. Various kinds of moss, of the greatest tenderness and the most splendid blending of colors, forming the richest Oriental carpets that fancy's witchcraft is able to produce, are spread out in enormous dimensions. In the seasons of calms, we can admire the wonderful *nuances* of their colors, in a depth of more than 100 meters. On the slopes of the elevations at the bottom of the sea, is the silky *Anferina*, its ribbed branches resembling trimmings of silk; and small, purple-red *algæ*, which, when standing together, give a red luster to the sea. Seaweed, or *fucus*, forming extensive meadow grounds in the Atlantic Ocean, is growing here also. These plants, when by some accident torn off from their native standing place, swim for years, on the surface of the water, without fading; and we see them floating, thousands of miles distant from their original place. A collection of floating berry seaweed (*Sargassum bacciferum*), extending from the Azores near Cape de Verde, and covering a space of 60,000 square miles, gives to this part of the Atlantic the name of the Sargasso sea.

In the waters surrounding the equator, there are plants belonging to the delicate *Florideæ*, having a bright red and yellow color; these plants cast their seed vessels far away, which then burst open, leaving the contents exposed to the pleasure of wind and waves; thus grain is spouting far away from its mother plant. The *Laminariæ*, resembling reptiles, when soaked and decayed sufficiently, are converted into a transparent gelatin, or jelly, which is regarded as a delicate dish in Chili, from Lima to La Concepcion. *Ulvæ* are found in great multitude in the waters of the oceans; some of them, by the name of sea lettuce, are eaten. But the most remarkable of all the sea plants is *fucus giganteus*, a species of seaweed. The cedar tree is called the giant of the mountains, but this fucus may justly be called the king of the sea. It rises out of a depth of 300 feet up to the water's surface; vast masses of this gigantic plant are swimming along on the waves, forming really floating islands, which seals and other sea animals and sea birds choose as their abode, to bask in and to sleep in comfortably. Navigators avoid these fucus isles like dangerous cliffs, or other perilous obstacles on their voyages. Around the equator, where calms are prevailing, ships sometimes get so entangled, in the vast networks of this seaweed, that they have to remain on the same spot for months until a violent breeze sets them free.

Among the sea plants growing close to the shore, there

are many, which furnish palatable food to men; others serve for industrial purposes, and form a profitable article of commerce. The *Borax* species supply us with iodine, which finds frequent application as a medicament, especially for scrofula; besides, it has been a great medium for art purposes, since the invention of dagurreotypes and photographs. By washing in lye the ashes of certain prickly *algæ*, growing on all the sea shores of Europe in vast multitude, soda is produced, which is a main ingredient of soap and is used in many other ways. Remains of plants, torn from the rocks by the ever toiling surges, and thrown up to the ocean's surface, during a storm, are spread over the soil, an excellent manure for it, and serve therefore to increase the prosperity and wealth of the inhabitants of the coast.

The submarine vegetable kingdom has by no means unvailed all its wonders to us; and the constant investigations of those men, who apply themselves exclusively to this branch of science, will reveal the greater discoveries in that department, in that it was formerly neglected by navigators and investigators.

The more we advance in the study and investigation of Nature, the more we see, with admiration and astonishment, what grand phenomena Nature produces by means insignificant, at least to our eye! Nature, unbounded in time and space, nevertheless uses all her powers with such wonderful economy, as if they were not inexhaustible.

From invisible evaporations caused to rise from the bottom of moist valleys, by the rays of the sun and condensed, at the hight of mountains, by the cold, Nature forms grand cataracts and large rivers. The insignificant, hardly visible *larvæ* of insects were sufficient to make the strongest, loftiest trees of our forest decay and fall into dust. A petty grain of seed, carried off by the winds or fallen down from a bird's bill, sprouts in a few days on a huge piece of rock, on which human power would in vain try its rage to destroy; but the feeble roots of this little plant force their twigs into the fissures of the most solid stones, and will gradually burst them open. A simple *polypus*, standing at the lowest point in the scale, among the lowest orders in the classification of animals, is Nature's medium at the bottom of the sea, by which new continents are created. One of the *polypus* species, the *Madreporæ*, belonging to the *Phytocorallia*, or plant coals, piling up silently, but incessantly and assiduously, layers upon layers of stones, are an example of what the most insignificant feeble creatures can do, when united. To the incessant work of the *Madreporæ*, future generations will be indebted for extensive fertile tracts of land, on which they can build their spacious and comfortable homes. The rocks of the *Madreporæ* and other *polypus* species may display themselves ever so grandly and so vast in extent to our eye, yet they are produced in a very simple, comprehensible way; for remains of rocks, stones and other earthy matters, united with the calcareous stone crust which these petty animals exude, form the only building material for the construction of new continents. Wood torrents, in their rapid fall, are tearing off, from our mountains, pieces of rocks, which the ever toiling surges, by and by, destroy and convert into pebbles and gravel. In this state, they are carried to the larger streams, and, by constant friction, the little stones are decomposed gradually till they reach the ocean in the form of sand. Earthy substances, melted by rain, roll down the mountain slopes, are carried along by the rivers, and now form valleys, originally plowed out by streams. The skilled eye of the geologist measures easily how much a river carries along of its own sandy shore, how much deeper it is digging its own bed, and how the latter is contracted in the course of time. Geologists compute the mass of earth that a river washes off yearly in its course through extensive valleys to raise, at its mouth, the bottom of the sea. The eye of the geologist sees everywhere primitive rock decomposed into sand, by the union of air and moisture, and following the rapid course of the mountain waters into the rivers which distribute it in the oceans. To the superficial eye of man, Nature only forms an inconsolable picture of disharmony and destruction; but a "thinker" admires, at every step, the grandeur and harmony as well in Nature's designs as in her way of executing them. Ebb and flood make rocks tremble, the force and power of the surges convert pebbles into the finest sand powder; but, at the same time, the sea is the reservoir in which all the rubbish and remains of the soil, on which we live, are gathered and consumed, and here Nature forms a new world out of the remains of an old one. These fragments of earth are not committed to casualty or to an arbitrary new compound. On the contrary, they separate or unite with wonderful regularity, according to their specific weight or the greater or smaller degree of their solubility, into various affinities in order to enter into new conditions and relations. A part of these remains, carried down into the depth slowly and gradually, accumulates there in vast masses, which, in the course of time, are hardened into solid rock, forming huge blocks, similar to those we find in our present stone pits. Another part of said remains is used by molluscs for the building material of their tender and delicate shells; some parts penetrate into the texture of certain plants, from which human industry extracts them in another form by the process of combustion; whereas not a small number of those remains serves the *polypi* for their wonderful works. The *polypus* is a diminutive gelatinous animal, furnished with feelers, by which it holds its food. A large number of these animals is attached in common to a little membrane, and every one of them is bound to its stone cell, which it cannot leave. Only a very few of them live singly; most species build a house in common, in which each one has its own petty apartment, like the larvæ in the cells of a beehive. Yet they form such a strict community, that the little particle of food one takes is sufficient for the whole family, and if a single one of them is hurt or wounded the whole family will die. They do not extend further down than a few fathoms, and die as soon as they are brought into connection with our atmospheric air. But we do not know much about the life and habits of these diminutive creatures; not long ago they were ranked among the vegetable kingdom. There is a great variety of them, all remarkable on account of the neatness and simplicity of their habitations. The longest known species is that which furnishes coral, and there is certainly no museum without a fragment of the works of this *polypus*, which is distinguished by its purple color and leafless form.

The coral is found in great abundance in the Red sea, whose not very deep bottom is converted into a miraculous garden by the numberless branches and ramifications of the *phytocorallia;* in the Mediterranean sea also, a vast multitude of them live. The coral fishery is to the inhabitants of the coast a rich source of commerce, business, and prosperity, and the city of Marseilles owes its flourishing state mostly to the coral trade.

AMALIE PFUND, *née* JANSSEN.

The Threaded Envelope Patents.

To the Editor of the Scientific American:

The article on the envelope openers, published by you a short time since (June 24), seems to have created considerable amusement among your readers.

More than this, you would evidently have people understand that there was no patentable or valuable difference between the two plans there presented. I beg leave to differ with you in this sentiment, premising that I have no interest in either of the patents named, and no connection or even acquaintance with the patentees or assignees of either.

I think it will be readily perceived that if a plain bit of thread be attached to an envelope of heavy material in the manner described in the patent of '58, and allowed to project ¼ or ½ of an inch, as indicated in your article, in nine cases out of ten the thread would slip through the fingers before the paper would give way, rendering the plan practically of little value, being equally if not more troublesome than cutting or tearing in the usual manner.

But our inventor of 1871 steps in with his knot on the thread, by which the user may seize and retain the latter between two finger nails, and thus easily tear out the material of the envelope. He, in fact, has done just what many another has done for more important inventions, rendered perfectly practical what before was experimental and unsatisfactory. It is not enough to argue that knots on threads are old, and that envelopes with threads are old, and other like fogyism, much of which is rampant in certain rooms of the Patent Office. I contend that the knot in this connecnection is novel, by performing a new function (not identical with that on the thread in the lady's work box) and by producing a more advantageous result than was possible with the old construction.

Furthermore, in the patent of 1871, the inventor claims a "knot on one or both ends of the thread," the latter plan doubly facilitating the operation of opening the envelope, as well as cheapening the construction; for the thread may be simply laid in the crease without any fastening whatever, except the knot at each end. If I were a lawyer, I would not hesitate to defend the "improvement" patent, as to novelty and utility (not as to infringement) in any competent court.

From knowledge of the characteristics of some of the present incumbents of the position of examiner, I judge that the latter patent was obtained from the more liberal Board of Appeals, whose opinion in the case is at least entitled to consideration. There *is* a difference (sometimes) betwixt tweedledee and tweedledum, and that difference is or ought to be patentable.

F. H. CLEMENT.

Rochester, N. Y.

Steam Plows.

To the Editor of the Scientific American:

Permit me to occupy a short space in your valuable paper, to show, in my opinion, where "Speed the Plow" is in error as regards the practical working of steam plows in America on what is termed the cable principle, or in other words, where the engine is stationed at the side of the field and draws the gang of plows back and forth, by means of a cable.

First, what, I think, as a general thing, the American people would accept as a practical steam plow, is a machine that is driven back and forth, across the field, and drawing its gang of plows after it. The working expense of such a machine would be far less than to do the same work by the English system of stationary engines and wire cables, as the traction engine with its gang of plows can be worked very easily by two men, while, the English plan (if I am correctly informed), requires four or five men to operate one of their machines. I quote the substance of Mr. John Fowler's words, when I say he considered it more economical to use two engines, one at each side of the field, than to use a single engine at one side of the field, and an anchor at the other side. If the using of two engines is more economical than a single engine with anchor, how economical it must be to plow by steam on that plan!

I do not believe the American people can be made to believe that it is a very economical way of plowing, where one engine is standing still and burning fuel while the other engine is at work, as it is necessary to have steam up in the one that is standing still, so as to be in readiness to go to work when its turn comes.

This plan puts me in mind of what I have frequently seen, where there would be employed a gang of men of double the number which were necessary to do a certain piece of work half of the number would be at work, while the other half would be standing up with their hands in their pockets, their pay going on at the same time.

Secondly, in plowing by the English system, there is, of course, a limit to the distance through which the gang of plows can be drawn. In large fields, such as are frequently met with in the Western States, it would be necessary to plow the fields in portions to correspond with the length of the cable. This would be another objection, as there would be too many headlands to be plowed or finished up by horses, an objection, which, if it was the only one, would, in my opinion, prevent said system of plowing from coming into general use in America.

Lastly, the price would be a serious objection to its introduction, as the engines and appliances necessary for working order, cost a sum which place them beyond the reach of men of ordinary means.

"Speed The Plow" seems to think that it is impossible to get up a traction engine that would be capable of drawing two plows, each cutting a furrow sixteen inches wide by twenty-six inches deep.

Permit me to say, from what I have ascertained by experimenting with different kinds of plows: The resistance offered to the draft by two of the most improved kinds of plows, cutting furrows of the above depth and width, was about 3,000 pounds to 3,500 pounds, a resistance which I have not the least doubt can be overcome by a traction engine, which would also propel itself. Furthermore, the traction engine with its gang of plows, can be built in America at a price which would not place it above the means of any but capitalists, although the prices of labor and material range higher in this country than in England.

Chestnut Hill, Philadelphia. W. H. H. HEYDRICK.

Boilers at High Levels.

To the Editor of the Scientific American:

The facts concerning the working of boilers at high levels are, I think, as follows:

That if a boiler, whose safety valve is arranged to work at 50 pounds under an atmospheric pressure of 15, be carried to an elevation where the atmospheric pressure is only 9 pounds, it will do the same service, when the safety valve lever or balance indicates an internal pressure of 50 pounds; because, although the actual internal pressure is only 44, the back pressure of the engine is reduced 6 pounds per inch.

You say that safety valves and pressure gages indicate the difference between the internal and external pressure under all circumstances.

Now please think again, and I believe that you will find that pressure gages are made to indicate an excess of internal pressure over the atmospheric pressure of 15 pounds per inch, so that if an ordinary pressure gage indicates an internal pressure of 50 pounds under an atmospheric pressure of 9 pounds, the actual internal strain on the boiler is 56 pounds per inch, which shows an increased strain of 6 pounds per square inch, when working according to the ordinary pressure gage.

Therefore, a boiler whose safety valve and pressure gage are arranged to work at 50 pounds per square inch under the atmospheric pressure of 15 pounds per square inch, will do the same service at an elevation where the atmospheric pressure is only 9 pounds per square inch, when the safety valve lever or balance indicates 50 and the pressure gage 44 pounds per square inch, on account of the reduction, of 6 pounds per square inch, of the back pressure on the engine.

JAMES GARLAND.

Providence, R. I.

Saccharate of Mercury.

To the Editor of the Scientific American:

Mr. Tunbridge, of Newark, takes exception to an article which you did me the honor of publishing in your issue of July 1, and states that "the only intelligible result of triturating mercury with sugar is to oxidise the former." I give an entirely different interpetration to the process.

The difficulty in getting mercury thoroughly incorporated with clay ore, or washings from crushing machines, renders it advisable, if possible, to combine the mercury with some substance soluble in water. If this can be effected, a very small quantity of mercury will do for the purpose, as it will be brought into contact with every particle of gold in the mass. I have rubbed mercury and sugar together in a mortar, and find that the sugar immediately acquires a pale gray color, the granules being coated with the mercury in the finest possible degree of comminution. If this powder be thoroughly mixed with pulverized ore, and the whole then washed with water, there will be no grain of earth, and consequently of gold, that is not in contact with metallic mercury. This is the theory, and it seems eminently practical. "Chalk, molasses, and many other substances" have no kind of fitness for the purpose.

D. B.

COMPENSATING FOR LEGAL SERVICES.—In Sir Walter Scott's Life there is an amusing account of his professional emoluments at Jedburgh. In one case Scott's client was convicted of housebreaking. After the trial the prisoner sent for him, thanked him for his exertions, and said he was sorry he could not give him a fee, but he would give him two bits of advice: First, that a yelping terrier, inside of a house, was a better protection than a big dog outside; and secondly, that no lock so bothered a housebreaker as an old, rusty one.

MILDEWED LINEN may be restored by soaping the spots, and, while wet, covering them with fine chalk scraped to powder, and well rubbed in.

The Selden Steam Pump.

We have been very much pleased with the working of this pump. The arrangement of its valves is peculiar and causes it to work with great steadiness. It seems well adapted to boiler feeding, as well as all the purposes to which such pumps are generally applied.

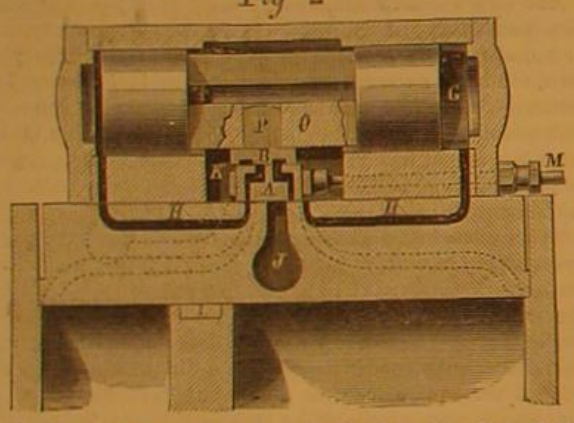
The steam piston and the pump piston are attached to a common rod, as shown in Fig. 1. On the middle of this rod is fixed a button, which operates a curved rocker with an upright oscillating arm which actuates the valve rod attached to the auxiliary valve, A, Figs. 2 and 3.

This valve is a three-ported valve, as is also the main valve, B. The auxiliary valve works directly under the main valve, as shown in Fig. 2. The two valves are fitted simultaneously, by placing the auxiliary valve in the recess, C, of the main valve, and facing them down together. Placing the auxiliary valve under the main valve obviates the jumping from its seat of the former, a difficulty experienced in some other pumps employing an auxiliary valve.

The purpose of the auxiliary valve is to obviate the necessity of an eccentric and fly wheel to actuate the principal valve, as the latter arrangement is liable during a slow motion of the pump (such as is needed in boiler feeding) to stop in the center.

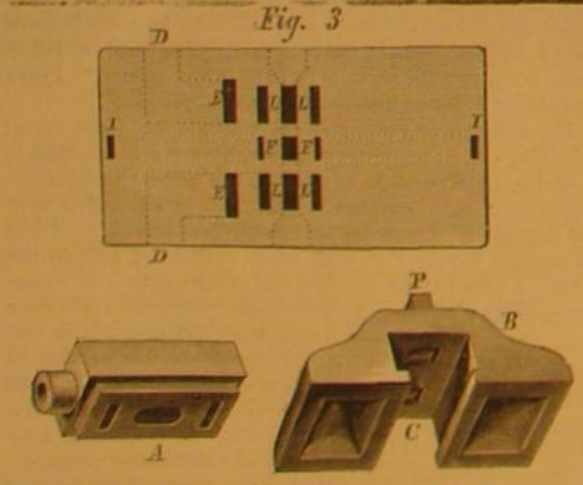
In the Selden pump, as in many other steam pumps now in market, the auxiliary valve admits steam to a cylinder containing a piston which actuates the principal valve, but it does this in a peculiar manner, claimed to possess important advantages over that employed in other pumps.

Fig 2



In Fig. 2—a vertical and longitudinal section through the main cylinder and auxiliary cylinder—the steam passages are shown; and in connection with Fig. 3, which is a plan of the valve seat, the course of the steam through the passages, and the action of the valves, may be easily traced. Steam is

Fig. 3



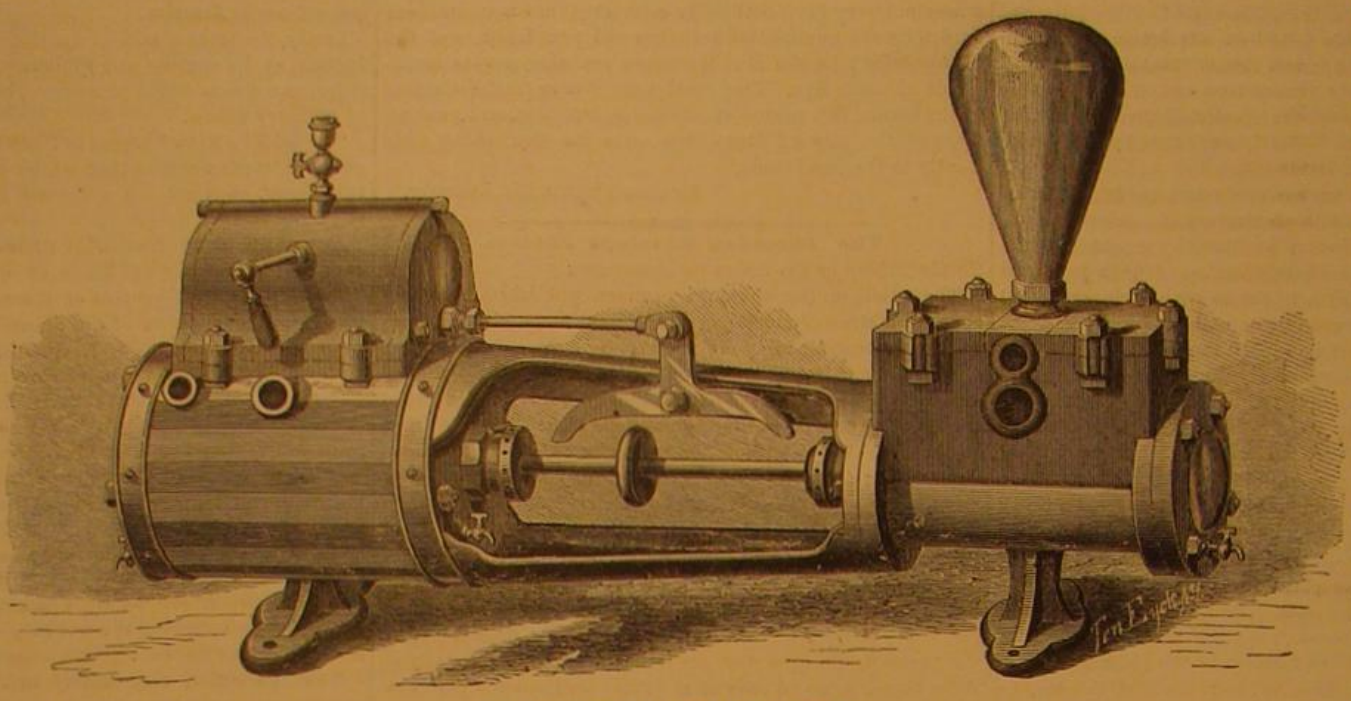
admitted to the steam chest, K, through the pipe connections, D, Fig. 3, extending, as shown in dotted outline, to the ports, E. Only one of these admissions is employed, but we hardly need to say that the supplying of one on each side is a convenience in setting these pumps in the variety of situations in which they are required to work.

This connection of steam pipes to the cylinder, of instead the top of the steam chest, is also a great convenience in another respect, as thereby the valves may be reached without disconnecting the pipes.

The middle series, F, of ports, are those covered and opened by the auxiliary valve, A. The outer ones of the series are the induction ports of the auxiliary cylinder, G, which cylinder is placed on the top of the principal cylinder, as shown in Figs. 1 and 2. The dotted outlines extending from the two induction ports of the series, F, show the course of the passages, H, Fig. 2; the ports, I, Fig. 3, being the openings of the passages, H, into the auxiliary cylinder. The middle port of the series is the exhaust port (shown in dotted outlines in Fig. 2), which opens into an exhaust passage, J, Fig. 2, this being the common exhaust passage for both valves.

The two exterior series, L, of ports, Fig. 3, are those covered and uncovered by the main valve, B, the outside ones being induction ports of the main cylinder, and the middle ones, the exhaust ports.

The piston in the main cylinder having made its stroke, causes the button on the piston rod to tilt the rock bar. This, through the rod, M, Fig. 2, opens the proper induction port



THE SELDEN STEAM PUMP.

of the auxiliary cylinder, and, admitting steam thereto, causes the duplex piston to make its stroke. In so doing, the rod, O, which connects the two piston heads, and which is also connected with the principal valve by the lug, P, moves the latter, and allows the principal cylinder to exhaust on one side of its piston, and fill on the other, thus rendering the action of the pump continuous, no matter how slowly it may move, and rendering the closure of the throttle valve the only means by which it can be stopped.

The auxiliary valve is caused to cushion by cutting off the exhaust in a very ingenious manner, not shown in the engraving, so that there is total absence of any shock in its working.

The piston in the auxiliary cylinder is fitted loosely, and consequently not liable to be fixed by corrosion of the metal.

The wearing surfaces being flat are easy of adjustment, and the compactness, simplicity, and small number of parts are conspicuous features. There is employed no construction unfamiliar to engineers, and hence repairs can be made or parts substituted in any machine shop most convenient.

The water cylinder or pump proper is double-acting, fitted with composition heads, and rings adjustable by screws or with leather rings or patent wood packing. The water valves are placed above and as near as possible to the cylinder so as to displace nearly all the water at each stroke of the piston, thus insuring uniformity of action throughout the stroke, and preventing the jar or concussion in the valve motion so common in this class of pumps.

The valve rods are composition, and the valves either rubbar or composition. The latter are easily accessible and can be removed by taking off two nuts, only a few minutes being required to clear out the valve chest and replace them.

Patented Dec. 20, 1970, by Wm. C. Selden, and assigned to Adam Carr, whom address, for further information, 43 Cortlandt street, New York.

Ammonia as a Motor.

Several months ago we described the operation, at New Orleans, La., of a street car, propelled by ammonia. The mechanism, we believe, was found on trial to require re-arrangement, and, the necessary changes having been made, now operates, it is said, to better advantage than before.

Liquified ammonia, when subjected to a heat of sixty degrees Fahrenheit, turns to a vapor which produces a pressure of sixty pounds to the square inch. This pressure is applied like steam and is subject to the same controlling influences. When intended to be used for the purpose of propulsion, the ammonia is poured into a system of tubes deposited in a tank of water in such a way that the gas which passes through the cylinder, instead of escaping into the open air may be carried through the exhaust pipe, and be absorbed by the water. In this manner the ammoniated water is preserved, and being redistilled, is capable of being used over again several thousand times, wearing out only at the rate of twenty-five per cent per annum. The gas is so readily absorbed by the water that it prevents any disagreeable smell or noise of concussion with the air. At the end of each trip the tubes are refilled from a stationary reservoir of liquid ammonia, and during the journey the heat lost by the tubes is acquired by the water in the tank, which re-imparts it, and prevents the ammonia from falling below the boiling temperature. The report of the Examining Committee, headed by General Beauregard, approves of the invention in terms which are too indefinite to be conclusive.

BAER'S DOOR FASTENER.

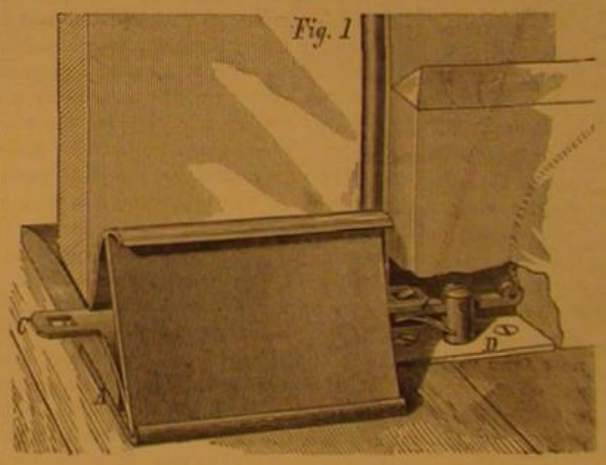
A great many devices, calculated to supply the deficiencies of ordinary door locks, have been invented, many of which have enjoyed a fair share of popularity, and met with satisfactory sale. Our engravings, this week, illustrate another claimant for popular favor in this field, which is so simple as not to require an extended description, and which, from its great strength, must fasten a door very securely.

This fastener is intended as a permanent fixture for doors, and not to be carried about in the pocket, as many inventions of this kind are. The construction of its parts is shown in Fig. 2, and its use in Fig 1. A, Figs. 1 and 2, is a flat plate with its edge recurved, which is screwed to the floor as shown in Fig. 1, its straight edge being inserted under the door sill, as shown, and its recurved edge projecting a little way from the edge of the sill.

B is a wedge piece, formed of a metallic plate, shaped as delineated. Projecting laterally from the base of this wedge piece are ears, C, with holes formed therein, as shown. D is a plate bearing a stud, in which is pivoted the spring catch, E. This catch is concealed in the wood, at the bottom of the door casing, as shown in Fig. 1.

The plate, A, having been previously screwed down to the floor, the wedge piece is, when it is desired to fasten the door, slipped in between the recurved edge of A, and the bottom of the door, as shown in Fig. 1. One or the other of the ears, D, is then caught and locked by the spring catch, E, as shown. When so locked, it is impossible for the wedge piece to be slid out of its engagement with the plate, A, by the insertion of a knife blade, or other thin instrument, beneath the door

Fig. 1

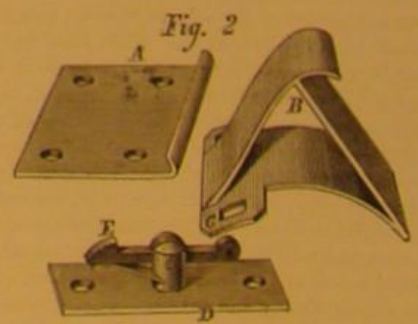


Two ears, C, are formed on the wedge piece to adapt it to use on either right or left hand doors.

To release the wedge piece from the spring catch, a cord or wire, indicated by the dotted lines in Fig. 1, is employed, which cord is passed through the wash board, or behind it, to any distance required, or to a place of concealment.

The inventor, however, claims that the wedge piece is of itself sufficiently secure without the bolt, so that the latter need only be employed by those who wish to make assurance doubly sure.

Fig. 2



This invention was patented May 23, 1871. The whole of the right for the United States will be sold, or rights to manufacture on royalty granted. Address B. F. Baer, patentee, 131 East Lemon street, Lancaster, Pa.

AN interesting application of electricity, in connection with a tank for supplying locomotives with water, is now in operation at Buda Station, on the Chicago, Burlington and Quincy Railroad. The steam pump which supplies the tank is on the bank of a small stream half a mile distant, and entirely out of sight. A float is arranged so that if the water be drawn off to a level more than two or three inches below the top of the tank a circuit, connecting by wires with the pump house, is closed. This sets an alarm bell ringing within hearing of the engineer, who then starts his pump, and runs it till the tank is full, of which due notice is given by the cessation of the alarm.

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NEW YORK, SATURDAY, JULY 29, 1871.

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THE SPECTROSCOPE AND ITS APPLICATIONS.

If our readers will turn to their files of the SCIENTIFIC AMERICAN, they will find the first mention of the spectroscope in July, 1861, on the occasion of the narration of the wonderful discoveries of Bunsen and Kirchhoff. The discovery was like the return to the sky of a forgotten meteor, vastly more brilliant than on its previous visit, and this time in such splendor as to dazzle all eyes, and at once to command and fix the attention of observers. The principles involved in Bunsen's application of the spectroscope were not new. Newton, Wollaston, Frauenhofer, Herschel, and Draper had previously discovered and explained them, but the philosophic way in which he and his colleagues turned to practical use the discoveries of his predecessors was what astonished the world, and opened up a new field of investigation. We have never seen a history of the course of reasoning that must have led Bunsen into the path which ultimately conducted him to such brilliant results, but we have our own theories on the subject, and propose to give them in this connection. In the summer of 1859 we spent some weeks in Heidelberg, and were frequently the guests of Bunsen and constant visitors to his laboratory. He was at that time engaged upon two researches in which light played the principal part.

His pupil Roscoe, now well known as the distinguished professor at Manchester, and the author of the best treatise on the spectroscope that we possess, was intrusted with one branch of investigation, namely the study, in some measure, of the actinic force of light, while the other branch, namely, flame reactions, seemed to chiefly occupy Bunsen's own attention. Roscoe has since published the results of his experiments in several important papers. Bunsen's flame reactions have been also given to the world, but being less startling than the spectroscope, have attracted less attention, although entitled to the highest consideration on the part of chemists. During our visits to the laboratory, Bunsen was full of this subject of the detection of various substances by the color of their light when viewed through different media, by the absorption of their rays in wedge shaped bottles, and by a great variety of ingenious contrivances, enabling him to analyze many minerals in a few minutes. It is well known that Bunsen always had a fondness for physics and an unusual knowledge of this branch of science. The chair occupied by him, however, was chemistry, and his special attention was confined to the students in the laboratory. At the university was a young professor of physics, a great favorite and the constant companion of Bunsen. This was Kirchhoff. These two men were every day to be seen in each other's society, taking long walks or discussing some knotty points of science, and nothing would have been more natural than for Bunsen to speak of his attempt to detect substances by the color of their flames, and than that the use of the prism should have been suggested in the course of the conversation. It requires no stretch of the imagination to picture to ourselves Kirchhoff examining substances by prismatic analysis at Bunsen's instigation. And once entered upon this line of research, the young professor was sure to attain the results that have since made him so celebrated. Bunsen, in his capacity of director of the mineral springs of Darmstadt, had occasion to examine various waters, and, as he was subjecting everything he could lay his hands upon to the new test, he fortunately took up some of the residues of the Durkheim spring, and thus it was that he found the new lines and hit upon the discovery of the new elements cæsium and rubidium.

Our business called us again to Heidelberg in 1862; and in the meantime the discovery, the dawn of which we unconsciously saw in 1859, had been made and published to the world. Kirchhoff had left terrestrial matters to his great master Bunsen, and had pointed the tubes of the instrument to the sun, and had given us the chart of the solar spectrum, and had established a new line of research in celestial chemistry. Bunsen took us at once into his dark room to exhibit the instrument called the spectroscope, and there pointed out the lines produced by the old and new elements when the flame of his burner was lighted by them. Kirchhoff showed us the coincidence of the lines in the sun with those produced by burning metals, and the grand discovery was complete.

Ten years have elapsed since the publication of the first paper in Poggendorff's *Annalen*, and since that time every year—we might say almost every month—has witnessed some new and unexpected application of the spectroscope to astronomical research or to the arts. On the occasion of the last total eclipse of the sun, the instrument mostly in demand and from which the chief service was expected, was the spectroscope. It revealed to the observers the nature of the corona, of the photosphere, of the sun flames, and was of the utmost importance in determining many hidden mysteries connected with this phenomenon. Having in a measure determined the nature of the atmosphere of the sun, of the moon, and of many planets, and helped us on the way to a clear understanding of the true character of the *aurora borealis*, we are startled by the announcement that the spectroscope can be used to measure the velocity of approach or recession in luminous bodies moving with great rapidity. We can detect and measure the movement of the stars commonly called fixed, by this delicate instrument.

It has been observed that if a luminous object approach with great velocity, the position of the image of the slit will be removed towards the violet end of the spectrum; if the body recede, the change of position is towards the red. If, therefore, we know the direction and rate of movement of the object, in order to establish a ratio between its rate and the amount of displacement observed in the image of the slit, we shall be able to measure or estimate the velocity of the moving body, by knowing what position the line or lines of its spectrum occupy when the body is at rest, and observing the position they occupy when in motion. This requires considerable knowledge of the heavenly bodies; and such knowledge is already possessed of the sun, and upon this orb the first experiments can be made.

The further applications of the spectroscope, to the detection of adulterations, to the study of physiology, to the manufacture of steel, to chemical analysis, to determine the intensity of aniline colors, have been noted in our journal.

They are a small part of what appears destined to grow out of this line of research, and it is safe to predict for the spectroscope, uses as great as has been made of the telescope and microscope.

THE ERIE CANAL NAVIGATION PROBLEM.

As might be expected, our table is deluged weekly with correspondence upon this topic. Most of these seek information, some contain suggestions of more or less value, others indulge in general remarks of little value or pertinence.

One correspondent makes the suggestion that the Commissioners should delay as little as possible in their action, as the conditions of the law entail necessarily considerable expense upon competitors, and this expense would, in many cases, result in serious embarrassment to inventors obliged to incur indebtedness in order to meet it.

Another suggestion is, that boats should not be made to suit propellers, but that propellers be made to suit the thousands of boats already in use. We have already shown that no propeller, no matter how powerful, could propel boats of the present model three miles per hour, without damage to the canal banks; and that, if this speed is to be secured, either the construction of boats, or the canal, or both, must be modified.

Boats are now made as large as they can be got through the locks. They draw water to within one foot of the bottom of the canal; and we are well informed that many of them are, or have been, allowed to be loaded to within six inches of the bottom. The new law requires that the boats shall carry loads requiring six feet draft, and that the speed of at least three miles shall be obtained. We have the opinion of an experimental boat builder, that the terms of the law are incompatible with each other. The arguments in support of this view have certainly much force. They may be summarized as follows:

The boats, to carry the loads required, must necessarily, as above stated, run very near the bottom. If the water be displaced, in order to avoid side swells, through under the bottom of the boat—which some devices are intended by their inventors to do, and which it is maintained is the only way to obviate side washing with blunt prowed boats—the water would be necessarily forced through this narrow space at a minimum speed of eighteen miles per hour, and when boats are loaded to within six inches of the bottom, the velocity of underflow would reach thirty-six miles per hour. These velocities are regarded as practically unattainable. The law in fixing the load at two hundred tuns, has virtually precluded a sharp prow and light draft.

Others, again, maintain that a boat may be towed from the bank at even higher speed than that required by law, without injury to the banks. A Brooklyn correspondent calls attention to the fact that the large bluff bowed lighters, when towed by the sharp prowed steam tugs that ply on our rivers, make scarcely any side swells in comparison to those caused by the tugs. He argues from this that although the swells of a propeller or side-wheel steamer seem to proceed from the bow of the vessel, they are in some way connected with the screw or paddle wheel, since the same speed attained by towing will not generate such swells. He attributes the swells to the generation of an undertow by the wheel or screw, the swell proceeding in reality from some point far in advance of the boat.

It is to be regretted that the Commissioners remain so long inactive, or at least silent, upon this subject. Judging from the tone of our correspondence, there will, or might, be a very lively competition for the large prize offered, were the course the Commissioners are likely to pursue fully announced and satisfactory to inventors at large.

Since writing the above we are informed that the Commissioners have had a meeting and organized, but adjourned without fixing upon any course of procedure upon the part of applicants. As soon as this is publicly announced, we shall publish it.

The Chairman of the Commission is Gen. Geo. B. McClellan, Dock Department, 348 Broadway, New York.

OUR CORRESPONDENCE.

We are grateful to our correspondents for their many favors. Their contributions upon practical subjects form one of the most valuable features of our paper. Our answers to queries, which are in large measure furnished by them, contain much useful information, and are doubtless perused with as much interest as any other department. Longer and more important papers published under the heading "Correspondence" appear also each week, and serve an important purpose in arousing thought and eliciting discussion. Never have these two departments been in a more prosperous condition than at present, yet we assure all who have anything practical or useful to communicate that there is still room for them. Whoever addresses the readers of the SCIENTIFIC AMERICAM speaks to a large and appreciative audience.

With the increase of correspondence, however, there is an increase of editorial labor, and it is with a view to save ourselves unnecessary addition to our already arduous duties that we have sat down to have a plain familiar talk with our correspondents.

It is not necessarily an indication that we regard a contribution inferior when we decline to publish it. There are many reasons why we may not wish to print a manuscript in itself interesting and well written. All communications addressed to this office, of whatever character, are carefully read and considered. If intended for publication, they may be rejected for one or other of the following reasons, namely: The subjects treated have been so fully discussed as to exclude them from further immediate attention. The topics treated may be foreign to the scope of our paper. The tone of articles may be offensive and vituperative. Articles may be so long as not to find available space, and yet of a kind which does not permit condensation. Other already accepted articles upon the same subject may preclude the acceptance of some excellent manuscripts. Articles containing nothing but speculative discussions will in general be excluded, as will also articles purporting to give practical information of a character too familiar to render its publication profitable. Articles the aim of which is to advertise the business of the writer, or the business of some person known to the writer, will be rejected, or, if accepted, will be pruned of objectionable features; and, in general, all articles treating of subjects which we think would, if discussed, be unacceptable to our readers at large, will be refused.

There may be other reasons for the refusal of manuscripts not enumerated, though we have named the chief. We have also a word to say as to the manner of writing.

There are many inconveniences to printers arising from writing on both sides of the paper. Communications intended for printing should therefore be written on one side of the paper only, and a wide margin should be left for typographical corrections.

Names of persons and places should be much more plainly written than ordinary words, as the context gives no clue to their orthography.

No anonymous communications should be sent. If correspondents do not wish their names to appear, a note to that effect should accompany the manuscript over their own signature, and the name or initials they wish appended should be stated.

Any remarks not intended for publication should be written on a slip by themselves, not on the manuscript.

If our correspondents will observe these simple rules, they will save us much inconvenience.

If it be desired to have manuscript returned if not accepted, stamps to prepay postage should be enclosed.

We publish in another column a list of manuscripts rejected within a reasonable time after their receipt.

We would suggest to querists that as some of their inquiries call out a certain class of advertising, they will often find information sought in our advertising columns; and we would respectfully suggest to those who seek to make use of our column of replies to advertise their business, that the proper place for them to do so is in that part of the paper devoted to advertising.

Architectural Engravings.

We commence, this week, the publication of a series of architectural engravings, obtained from the publisher of the London *Builder*, a periodical devoted to architecture and art, and which, in size and character of its illustrations, stands unrivaled by any other publication of its class printed in the English language. Of the high artistic merit of the illustrations to follow, the one presented this week is a fair sample. We believe that this series of illustrations will be studied with much interest and profit by architects and persons of artistic tastes.

TO DRAIN LAND in level places, sink a well down to the first porous stratum. The water from the upper soil will flow readily into the well, especially if drain pipes or tiles be laid in its direction.

SCIENTIFIC INTELLIGENCE.

APPLICATION OF AIR BLASTS IN THE ARTS.

The necessity of oxygen for combustion has been known for nearly a hundred years, and all iron furnaces are provided with a powerful blast, but the application of the same principle to other operations, not being so obvious, has hitherto escaped attention. In recent times, however, we note the adaptation of air blasts to several important processes, particularly in wine making and bleaching paper pulp. If wine be left to itself, it requires months and sometimes years for the nitrogenous constituents of the must, the albumen, gluten, etc., to be removed by the slow process of oxidation. M. d'Heureuse has found that this waste of time can be avoided by blowing rapid currents of air through the must, and thus accomplishing in a few hours what under the old system required as many months. If the operation be carried too far, there may be some danger of carrying the grape juice through the first fermentation into the formation of vinegar, and it is quite worth investigating whether, in this way, acetic acid could not be rapidly and economically manufactured. Another ingenious application of the air blast was mentioned on page 25, current volume, where we gave an account of an invention made by John Campbell, of Chatham, N. Y., for bleaching paper stock by aid of a blower or powerful current of air. It seems to be pretty thoroughly established that it is the liberated oxygen of the chloride of lime that accomplishes the bleaching, and not the chlorine, and hence, if an extraordinary supply of oxygen be forced into the bleaching vat, it stands to reason that the operation will be greatly facilitated. Whether ozone is actually generated in this way remains to be proved, but without the necessity of calling in the theory of ozone to explain the reaction, the practical result is certainly to bleach any stock in much less time, and with one third the amount of chloride of lime. We incline to the belief that powerful blasts of air could be advantageously employed in the precipitation of water for drinking purposes, in the refining of sugar and sirup, in bleaching all kinds of goods as well as paper stock, in the treatment of wine to promote fermentation, and in general, for all purposes where an extraordinary supply of oxygen gas is deemed to be necessary. We throw out these hints for the benefit of inventors, and may give the subject a more thorough examination in a future article.

THE HEAVENS FROM A SOUTHERN POINT OF VIEW.

Our readers are probably aware that some time since Dr. B. A. Gould was appointed director of the Cordoba Observatory. We now learn, from a letter to the editor of the *American Journal of Science and Arts*, that this distinguished astronomer has reached his destination, and has already commenced the labor of mapping the stars of the Southern hemisphere, that is, the preparation of a catalogue of all stars between the South Pole and 10° north declination. The sky of Cordoba possesses a wonderful transparency, and exhibits to the trained eyes of Dr. Gould and his assistants, an almost incredible number of faint stars, probably at least twice as many as can be seen in the most favorable nights at the north. For example, they find in *Orion* twice as many stars as are given by Argelander in his chart, and in *Canis Major*, they define 200 stars, while Argelander saw but 39. Our knowledge of Southern constellations is limited, and much of the Southern sky is utterly unknown to us, so that Dr. Gould has a field of research comprehensive enough to satisfy the most devoted astronomer. After so long a period of inaction, a new day seems dawning for stellar astronomy in the Southern hemisphere.

THE *Gardener's Chronicle* (England) publishes more recent intelligence of Dr. Hooker and his party under date "Camp, Atlas Mountains, May 19th." They had succeeded in reaching the top of the crest of the Atlas, nearly due south of Morocco, at an altitude of about 11,500 feet, the upper 3,000 feet of which were very steep indeed, very rocky and stony, with a good deal of snow, and the temperature 24° Fah. The flora of this upper region appears to be excessively poor: they did not find a single really Alpine plant, "and few plants of any kind; no gentians, primroses, anemones, ranunculi, or other types of an Alpine flora. The rocks were chiefly a very hard porphyry, red, black and gray, with granite here and there, and beds of limestone, all hard and obnoxious to plants. Moreover, these steep upper cliffs of the Atlas are alternately roasted by a blazing sun, or parched by a Sahara sirocco, or swept by moist northwest Atlantic gales, which bring heavy snow storms such as we experienced, probably throughout the year. The flora, up to 7,000 feet, on the contrary, is exceedingly rich, varied, and beautiful;" and Dr. Hooker thinks that their collections will prove of very great interest and considerable extent. Many English plants find their southern limits here, and there is an abundance of roses, bramble, elder, honeysuckle, ivy, ash, poplar, etc.

CINCINNATI INDUSTRIAL EXPOSITION.—The exposition for this year will open on September 6, and continue to October 7, inclusive. Preparations are being made for an exhibition of inventions, products, manufactures and works of art of every class and of the most varied attractions; and the show will doubtless draw thousands of visitors to Cincinnati, a city which, as a manufacturing and commercial center, stands high among the cities of the world. A. T. Goshorn, of the Cincinnati Board of Trade, is the President, and H. McCollum, of the Ohio Mechanics' Institute, the Secretary; and these gentlemen have, united with them, other prominent and well known members of both these bodies, and of the Cincinnati Chamber of Commerce. Thus the venture starts well, and under the most favorable auspices, and we wish it every success.

ALABAMA AGRICULTURAL AND MECHANICAL FAIR.—The Alabama Agricultural and Mechanical Association has forwarded us the list of premiums to be awarded to exhibitors at the fair to be held at Montgomery on October 16, 17, 18, 19 and 20 of the present year. The premiums amount to $20,000, and are to be awarded for growing crops, samples of field crops, samples of sugar, cotton, and other produce; agricultural implements, machinery, works of art, domestic utensils, needle work, fruits, flowers, vegetables, cattle, horses, minerals and metals. The Secretary of the Association is Mr. Hal. T. Walker, Montgomery, Ala.

BLACKBERRY WINE.—Our numerous lady readers may find the following recipe acceptable: Crush the berries with a wooden pestle in a wooden tub or bucket; draw off all the juice, and add to it an equal quantity of water, and two pounds of refined sugar for each gallon of the mixture. Keep it in jars till the fermentation is complete, and then bottle and cork it up. A second fermentation will take place in the ensuing spring, during which another pound of sugar should be added to each gallon. The wine thus prepared will keep well, and improve by age.

Examples for the Ladies.

Delia A. Eply, Buren Springs, Mich., has used her Wheeler & Wilson Machine 7 years without repairs; earned, making cloth garments, in 1869, $785; in 1870, $587·65, besides doing the family sewing for four persons; has used one needle over a year on heavy work.

"Geo. P. Rowell & Co., 40 Park Row, New York, Advertising Agents, is a model business house. They give more for the money than any other house in the world."—*City Item, Phila.*

"Whitcomb's Remedy for Asthma enabled my wife to sleep quietly."—*Kimball Hadley, Wardsboro', Vt.*

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.

Manufacturers of Furniture—I want to buy full stock. Send price lists to T. T. Edmunds, Columbus, Georgia.

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Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

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Notice to Inventors.—J. R. Gilchrist, Mt. Pleasant, Iowa, has facilities for casting, finishing, and plating copper, brass, zinc, etc., and would buy a good invention or manufacture for others. Samples of his celebrated Lightning Rod Points sent to the trade free.

Sell your patents for the Pacific coast through Wiester & Co., 17 New Montgomery street, San Francisco, Cal.

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A water power, 25 feet fall, with job shop and saw mill. Also a 4½x12 stationary engine, with flue boiler. For sale cheap. Address G. B. Keeler, Port Chester, N. Y.

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Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

The Baxter Steam Engine is manufactured by Colt's Arms Co., Hartford, Ct., and sold by the B. S. E. Co., 18 Park Place, New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.

Answers to Correspondents.

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

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

CHEAP BATTERY.—The cheapest and most efficient battery I can recommend to T. G. B. may be constructed as follows: For a cell use a large glass tumbler. Get a sheet of zinc (a thick plate if possible) almost as wide as the tumbler, and long enough to reach to within an inch of its its bottom, and a strip of sheet copper, somewhat narrower than the zinc plate, but twice as long. Take a strip of hard, well dried wood, about ½ inch wide, and long enough to extend across the top of the tumbler, and having made a sufficiently large mortise through its center, into it fasten the zinc plate, by wooden wedges. Next, bend a copper strip into the form of a U, having the legs ½ inch apart, and fasten this upon the wooden strips so as to enclose the zinc without touching it. The whole system thus formed will sit firmly in the tumbler. To charge the battery, fill the cell nearly full of a saturated solution of bichromate of potash, and then add dilute sulphuric acid until a slight effervescence takes place. The zinc plate should be amalgamated. This battery works with remarkable vigor, being superior to Smee's or Daniell's, although not so constant as the latter. For further security the wooden strips should be varnished, and of course, terminal wires must be soldered, one to the copper plate, and the other to the zinc. For the telegraphing apparatus an electromagnet and a key are required. An electromagnet is but a bar of soft iron wound with insulated copper wire, the winding being at all parts in the same direction. This may best be understood by taking a straight bar, and commencing at one end and winding it throughout the whole length and back again; but as it is not convenient to bend the bar after being wound, it is first bent into the form of the letter U, and wound afterwards. A small bar of soft iron is to be fixed by a spring at a little distance from the free ends of the electromagnet, and capable of motion such that when the magnet is excited, the bar may be brought into contact with its ends, and thus make a "click," while the spring may carry it back when the magnet loses its charge. The key may consist of a metallic spring, having one end fastened upon a board in such a manner that when at rest the other end may be elevated about ½ inch. Under the free end is a metal button, or merely a piece of wire so placed that the spring may be brought into contact with it by pressing its free end down. These things being arranged, the connections are made as follows: By a copper wire, connect the zinc plate with the fixed end of the spring in the key; connect the button with one extremity of the electromagnetic coil; and connect the other extremity of the coil with the copper plate. Then, whenever the spring in the key is pressed down, connection is complete between the coil and the battery, the magnet becomes charged, and the armature or small iron bar is drawn into contact, making a sharp "click;" when the spring is suffered to rise, contact and hence metallic connection is broken, the magnet loses its power, and the armature is carried back by its spring attachment. It will not require the exercise of much ingenuity for J. G. B. to arrange these several portions of the apparatus, in a way best suited for his purpose.—NEMO.

RECOVERING MERCURY FROM OLD BATTERY PLATES.—G. E. will probably find it most easily effected by distillation. Break the plates into pieces, and put them into an iron retort, furnished with a delivery tube. Heat to a temperature of about 1000° Fah., and, upon continuing this heat for some time, the mercury will distil over, and may be collected. If the delivery tube be of considerable length, no other condenser will be needed.—NEMO.

BENZOLE can be separated from the light oil of distilled coal tar by a second distillation. Benzole distils over at a temperature varying from 176° to 190°; below the lesser limit, the lighter oils (rhigoline, chymogen, etc.) pass over; above the higher one, kerosene and others volatilize.—W. E. S. F.

MERCURY.—G. E. can recover his mercury from old battery plates by dissolving them in dilute oil of vitriol (H_2SO_4) and heating the finely divided mercury under water until it unites.—W. E. S. F.

COATING GLASS.—Let C. E. G. wash the demijohn thoroughly, then fill with a dilute solution of nitrate of silver, to which add a strong solution of sugar and let the demijohn stand for 48 hours.—W. E. S. F.

LOCAL LICENSES AND PATENTS.—I wish to inquire if the patentee of any article, or his agent, is obliged to pay town or city license to canvass or introduce the article. If so, how do letters patent relate to town or village ordinances? In this case the license is from $2·00 to $5·00 per day for canvassing, which is rather a heavy addition to expenses for a person of moderate means.—J. Y. D. ANSWER.—Town and county licenses have nothing to do with patents. Hackers, and persons who go about to sell vegetables, household goods, and other articles must procure a local license. The grant of a patent does not exempt any one from the operation of local laws. If you become a vender of any article, whether patented or not, you must obtain a license.

ROACHES.—About twenty-five years ago I occupied a house in Brooklyn, N. Y., that was much infested with roaches. So numerous were they that having a door cut through the partition between the kitchen and dining room, the workman said that he took a peck of roaches from between the base boards in the space thus opened. A short time afterwards, the roaches entirely disappeared, and never returned during the time we occupied the premises (nine years), but mice made their appearance before we had missed the roaches. I thought at the time that the mice drove them out, and had determined to try the experiment, but no opportunity has ever offered since, so I send you this that others may try it if they see fit.—H. W.

CRUDE TARTAR.—The chief impurity in crude tartar is the tartrate of lime. The process for purifying the tartar is founded upon its greater solubility in hot than in cold water. Pulverize the tartar, and boil it with water in a large boiler, until the solution is saturated. Cool it, when the tartar will deposit, in an almost colorless crystalline layer. Remove this layer and repeat the operation, when a tolerably good article will result. To remove all color, add in the second boiling about eight per cent pipe clay, and evaporate almost to dryness.—W. E. S. F.

TURBINES.—In answer to J. C. W.'s query about turbines, I would say: if a draft tube is to be used, his is the best way, as a larger tube can be employed (thus reducing the friction) without danger of the air not being washed out. Likewise, it there be any deficiency in the tube, it will show itself, and the reaction will be more complete, as no squirting of the water can take place. The subject is a difficult one. I propose to give a few thoughts, first on theory, and then on practice. Suppose you take a piece of chalk, draw a square inch on one side of your hand; it is hard to make you believe that there is a pressure of 15 pounds upon it. But draw another square inch on the side exactly opposite to it; the one pressure balances the other, and they are to you insensible. But put one of the squares on the mouth of a tube and exhaust the air, and you will very soon feel the pressure. Now, suppose you build a penstock 30 feet deep from bottom to top of fall, and put a turbine wheel, 15 feet from each end, on a water and air tight floor; the air pressure on the top water will be 15 pounds on the square inch. Now, suppose you keep the water out, and exhaust the air column on top of wheel; the tail water column of air will force the water up through the wheel, driving it backwards till the water column reaches the top, when it will balance the air column, and motion will cease. Again, suppose you exhaust the air below the wheel; the air column on tail water will force up a column of water to wheel, weighing 7 pounds per square inch, and pressing against the wheel with a pressure of 8 pounds per square inch. This is met by the descending water, pressing 7 pounds to the inch, and upper air column of 15 pounds, making 22 pounds of pressure above the wheel, and 8 pounds below, leaving an effective pressure of 14 pounds per inch, which, after all, is the weight of a water column 30 feet high. It will be seen from this that nothing is gained or lost, either by suspending or immersing the wheel, if the penstock be built from bottom to top of fall (and the penstock ought to be, in its horizontal area, 100 times greater than all the discharging areas of the wheel added together, thus reducing lost motion in the penstock to 1 per cent.) But if, on the other hand, the penstock be built only from the wheel up, and a small rough, cast iron pipe for draft tube to tail water be used, the theoretical 7 pound pressure of the lower water column will be reduced to perhaps 5 pounds of effective pressure against its ever present active and frictionless enemy, the 15 pound air column on the tail water, and the effective power of fall will be reduced from 30 to 26 feet.—J. W. H., of Del.

BELTS.—One of your correspondents wants to know how it is that his belt runs to the high side of the pulley; another answers, because it is tighter. Allow me to state that a belt no more than anything or anybody else wants to get in a tight place, but is forced there by circumstances over which it has no control. When a pulley has a high side, the angle of its face is always greater or less than 90° to the plane of rotation, while the line of direction of the belt is always in the plane of rotation, or at right angles to the shaft on which it and the pulley is fixed. Suppose you take a pulley 24 inches diameter, 6 inches face, and bore and turn it; cut the edges true. Set your lathe so that it will turn one end of the pulley 23¾ inch, and the other 23¾ inch. Put the pulley on the shaft, take a straight edge or line across the edges of pulleys; set it in line with the pulley with which it is to work. Now take a square, and apply it to the face of the tapered pulley. You will see that the lines of the straight edge and square are not exactly parallel. The belt runs in the direction of the straight edge till it strikes the pulley, then it runs in the direction of the square, and becomes bent, and in its efforts to straighten itself runs up or over a little, as the case may be. We were first led to question the orthodox saying that belts always run to the high side, when putting up some cones about 6 feet long, 22 inches diameter at the one end and 11 inches at the other; they were straight cones, placed about 12 feet apart from center to center, broad end of the one turned to the narrow end of the other; when the belts were put on, to our surprise, they tended to run to the high end of the one, and the low end of the other.—J. W. H., of Del.

FIXING PENCIL MARKS.—I have tried various methods for fixing pencil and crayon drawings. The recipe which I send you, I have found the cheapest and least objectionable. It is copied from "Chapman's Drawing Book," page 251. To a saturated solution of alum in pure water, add as much fish glue (isinglass) as may form a size of the proper consistency (which can only be regulated by the character of the drawing for which it is intended). Let the solution stand for about thirty-six hours, after which it should be boiled, and when cold, passed through a linen cloth. Add about an equal quantity of some colorless spirits or diluted alcohol. Put the solution in a dish or wooden tray, and, holding the drawing horizontally, face downward, gently immerse it therein, and almost immediately lift it out, without changing its horizontal position, in which it must remain till dry.—LIZZIE.

CHEAP LAUNDRY.—You will please let me add a few suggestions in reference to a cheap laundry. It seems to me that the principle of spreading clothes on the grass to bleach might be taken advantage of. Every country washerwoman knows that if clothes be thoroughly wet in strong suds, and spread on the grass when it is raining, if it continues to rain for ten or twelve hours, they will be washed almost clean. The clothes, however, are very apt to get stained from the grass. This could be remedied by spreading the clothes on galvanized wire frames, which might, by some simple contrivance, be made to pass under a sprinkling spout.—LIZZIE.

CRACKING OF CASTINGS.—L. A. P. must regulate the cooling of his castings. The trouble is that the rim of his wheel cools long before the hub; then when the hub cools, it shrinks, producing tension on the arms, and proportionate strain on the rim of the wheel. Let him take away the sand above and below the hub, and knock out the core, allowing air all around it, keeping the rim covered in the sand. I have seen pulleys taken out of the sand sound, and upon centering in the lathe, using a wooden block, they would part, usually in the arms. The blow being light and the pulley loose on the face plate, showed that the casting was on a strain.—G. S. K.

ELECTRIC MACHINE.—H. L. C. does not want an electrical machine to be turned by hand to give power to propel his electrical engine. He should use electromagnets in his engine, which will derive their power from a galvanic battery.—M. L. B.

QUARTER TWIST BELT OPENINGS.—Let J. E. D. lay out the centers of his belt holes, as directed in the article with diagrams, on page 85, Vol. XVIII (Feb. 8, 1868), SCIENTIFIC AMERICAN. Since the belt twists 90° in passing from one pulley to the other, it is plain that if the floor were just half way between the centers of two pulleys of equal diameter, the angle of the plane of the belt with the shafts at that point would be 45°, and this would also be very nearly true for pulleys of unequal diameter. It is obvious, also, that the nearer the floor is to one pulley, the nearer parallel with the shaft of that pulley will the belt opening be. Thus, suppose the floor to be 3 feet from the lower pulley, and 9 feet from the upper one; 90° divided by 12 feet (distance between shafts) = 7½° twist to one foot; and 7½ x 3 = 22½° twist. Draw lines through the centers first found, parallel with the shaft nearest the floor, set off the angles thus calculated, and draw the diagonals, which will be the center lines of the belt holes. In wide belts running on a quarter twist, there is, of course, a slight curvature from side to side, but it is hardly necessary to take that condition into the problem. Moreover, J. C. D. will find it economical to run a very wide belt in that manner.—F. H. C. [The diagram referred to will be found in another column.—EDS.

CLOTHING STEAM PIPE.—If B. L. C. will cover his long steam pipe with hair or wool felting, 1½ or 2 inches thick, he will have no trouble with water. The felting is made for the purpose, and sold at supply stores.—P. B.

SETTING BOILER.—If I were A. M., I would not set my boiler as he proposes. I would set it in the usual way, having the grate surface as large as possible, the space under the boiler, behind the bridge wall, 3 feet deep for a combustion chamber (if I used coal), and at the hind end contract the flue, immediately on leaving the boiler, to as small as the stack, and smaller if the stack be over 18 inches square.—P. B.

TO KEEP FLIES FROM HORSES.—I have employed a remedy for the last fifteen years, both for horses and cattle, which I wish could be known to everybody. Procure a bunch of smartweed, and bruise it to cause the juice to exude. Rub the animal thoroughly with the bunch of bruised weed, especially on the legs, neck, and ears. Neither flies or other insects will trouble him for twenty-four hours. The process should be repeated every day. A very convenient way of using it, is to make a strong infusion by boiling the weed in water a few minutes. When cold it can be conveniently applied with a sponge or brush. Smartweed is found growing in every section of the country, usually on wet ground near highways.—E. H. G.

TO KEEP GLUE FROM SOURING.—If a little muriatic acid be put into glue when it is dissolved, ready for use, it will retain the glue in the same condition for a long time. It will neither dry up, nor ferment. Liquid glue is made in this way, and sold in bottles. The use of a small portion of sugar of lead will also prevent fermentation.—E. H. G.

COATING GLASS DEMIJOHN.—I would suggest to C. E. G. the possibility of coating the inside of his demijohn with collodion, afterwards blackleading this, and then, by filling it with solution of sulphate of copper, deposit a lining of metallic copper by the battery. Perhaps a solution of beeswax in spirits of turpentine would be preferable to the collodion.—M. L. B.

SPEEDING PULLEYS.—Proceed as in vulgar fractions, placing the number of revolutions of the prime mover as a numerator of a compound fraction, and the diameter of each of the driving wheels in inches also as numerators, and the diameters of each of the pulleys in inches as denominators (or divisors), and proceed by cancellation.—O. L. L.

RELATIVE POWER USED IN TURNING INSIDE AND OUTSIDE OF CYLINDER.—G. S. R., of Mass., will, I think, see, on reflection, that the difference arises from the impossibility of holding the tool against the inside at the same angle as against the outside. This is owing to the difference between a concave and a convex surface. Moreover, the centrifugal force of the revolving cylinder is in favor of cutting on the outside, and against cutting on the inside.—D. B., of N. Y.

CIRCULAR SAW.—I think if B. L. C. will use flat rings of paper, which will fit the arbor, he can correct the dish of his saw. He should first put them on, then slip on the loose collar, and continue to close until the collar will not come quite up to the saw, (for the collars are turned out hollow, or "dishing"). Turn up the nut tight, and try with a straight edge; if not right yet, use others until the saw is flat. If the saw have bumps or sprung places by overheating, send it immediately to a saw maker for repairs. This fault can be easily detected by a bright place on one side, and a corresponding black one on the other.—W. W. W., of N. Y.

CIRCULAR SAW.—E. A. M. will find by experiment that a thin saw will run easier than a thick one, regardless of the number of teeth, but either will run easier with thirty than sixty teeth.—A. G., of Me.

DISHED CIRCULAR SAW.—If B. L. C. will take his saw from the arbor to a smooth faced anvil, and with the sharp end of a smith's forge hammer, hammer in straight lines, from or near the center to the outer edge, increasing the force of the blows gradually from the center to outside, by taking care not to hammer too much he will have no trouble in truing his saw.—A. G., of Me.

SPEED OF CIRCULAR SAW.—If T. W. B. will run the cutting edge of his saws 9,000 feet per minute, he will find that a very good rule.—A. G., of Me.

TO KEEP FLIES FROM HORSES.—If your correspondent, F. N. P., will take a sponge saturated with fish oil, and sponge his horse with the same, he will not be bothered with flies. A very simple and effective remedy.—C. D.

BOILER PIT.—E. H. H. could not prevent the water running into his pit by "plastering or pointing" on the inside, for the reason that the adhesion of plaster or point to the walls would not be sufficient to resist the pressure from without. His pit being 6 feet deep, and the earth on the outside being fully saturated, the pressure to be resisted is the same as if his pit walls were but a coffer dam in a simple body of water. And since a column of water 1 inch square and 28 inches high, weighs 1 pound, the pressure at the bottom of his pit is 2·21 pounds to the square inch, or 318·24 pounds to the square foot. The only way in which he can make his pit tight, is to plaster carefully, with good cement, the vertical walls on the outside, and put in a concave bottom, or one of sufficient thickness to resist by its weight the pressure from beneath, which pressure is equal to that upon the sides at the same depth.—S. C., of N. Y.

BITUMINOUS AND ANTHRACITE COAL.—Noticing in your issue of July 8, a query, relative to bituminous and anthracite coals, from G. H. W. (No. 13), as to which was the most economical and best to use, and which injured the boiler most, I will state that after 25 years practical experience as an engineer, and after testing the various kinds of coal in all kinds of boilers, I have come to the conclusion that bituminous coal is the most economical, is less injurious to boilers, and makes steam better than any other coal.—F. H. S., of Conn.

T. G. B. does not need a battery or electromagnet to learn telegraphy; he wants simply a train of gearing (like a clock) to carry two rollers, between and by which his paper is drawn, and a pen lever, whose pen or point will, when brought in contact with the under side of the paper, press it into an annular groove in the upper roller. This pen lever, hung in its middle, may be worked by grasping its outer end in the same manner as a telegraph "key." If H. L. C. or T. G. B. will address me—"Lock Drawer 135, Aurora, Ill.,"—I will be pleased to give him gratis, full information, drawings, etc., which would take too much space in your paper.—M. L. B.

A. H., of Wis.—The mineral you send is iron pyrites—contains no lead or silver. Is of no great value.

J. E. W., of Ark.—There is no known substance through which magnetic attraction will not act.

J. W., of Ind.—If the cooling effect of air blown upon the surface of the body were confined simply to the imparting of heat through radiation to the air, fanning, with the air at 102 degrees, would be of no use. But the larger part of the heat carried off from the body is conveyed away by evaporation from its surface, and this is greatly facilitated by a constant change of air. The body will therefore be cooled by air currents at temperatures above "blood heat."

J. W., of Ont., wants to know whether the pressure of wind blowing into a funnel-shaped vessel, having the small end truncated and closed, will be that due to area of small end, or that due to the area of the large end. We answer: That due to the area of the large end.

J. H. M., of N. Y.—Living so near as you do to the great public libraries of New York city, we cannot advise you better than to search them for the early history of the steam engine you are seeking. These libraries contain a great many books relative to this subject, from which you may gather nearly every fact of importance, calculated to shed light upon the part taken by early inventors, from Hero down to the present day.

C. S., of Ohio.—We can not give you the address desired.

L. B. G.—There is no rule for locating fixed pulleys on shafts placed in the same plane, but inclined to each other. A belt will not run on pulleys so placed.

W. P. S., of Pa.—The rotation of a body on its own axis does not in any way interfere with or influence the action of gravity upon it.

LUBRICATING OIL.—If S. R. will send to Chard & Howe, 134 Maiden Lane, he will receive sample of oil that will answer his purpose.

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.—TABLE CUTLERY.—I have been put to much annoyance and expense by loss of "temper" on the part of my table cutlery, especially of carvers; and I would like to inquire through your valuable columns whether it is possible for the steel to lose its temper by being in scalding water for any length of time. I have purchased every variety of carvers, and for a short time they keep an edge, but soon they become utterly worthless. Will some one give me a hint on this subject?—R. S. S. H.

2.—HULLING STONES FOR RICE.—We use in the preparation of rice a millstone for hulling, soft, free, and therefore self sharpening. It often occurs that there are hard spots which cause unequal wear, and consequently split and injure the grain. Can some one suggest a remedy? The stones are worked open upon a fixed frog or rind, and therefore differ from those used for ordinary grinding.—R. R. L.

3.—GLUE OR CEMENT FOR OILED WORK.—Do any of my brother wood working mechanics know how to prepare glue or a cement to be used on wood that has been coated with linseed oil, so that it will make as strong a joint as on the raw wood, and with little or no more trouble than the common glue in use?—H. H. R.

4.—DIMENSIONS OF BOILER.—Will some of your numerous subscribers give me dimensions of a Watertown boiler, capable of running a 3 by 10 inch cylinder engine, of a pendulum oscillating construction? I think of having a hole under the grate bars for ashes to drop through, etc., similar to a fire door in an upright boiler. Is it a good idea?—J. P.

5.—WATER PIPES.—Would it not be possible to line an iron pipe with porcelain, in the manner of preserving kettles and other hollow ware, which would protect the iron and furnish a pipe cheaper than block tin, and bring us water free from all mineral contamination? If so, where can I obtain some of this pipe? In conclusion, allow me to advise all persons using water conveyed by lead pipe, to ascertain at once whether they are taking this insidious poison into their system. H S gas is easily prepared from Fe S and H Cl by any amateur, and after concentrating a gallon of the water to half a pint, the insoluble oxide and carbonate may be collected on a filter, when a solution of sulphureted hydrogen poured on the filter will at once prove its presence. To determine the exact quantity present requires more skill and delicate apparatus. The presence of even a trace of lead may in time result in paralysis and even death.—E. J. H.

6.—STEEL AXLE TURNING.—How can I turn steel axle journals so that I can have a smooth finish without filing the same?—D. D. D.

7.—WASHING ETHER.—Will some of your "chemical" readers inform me what is the process of "washing ether"?—E. H. M.

8.—CASTING BRASS IN IRON MOLDS.—Can some one of the many readers of the SCIENTIFIC AMERICAN tell me how a brass cylinder say six inches long, by one inch outside and three fourths of an inch inside diameter, can be cast in an iron mold? There are some irregularities outside, so that I cannot use tubing. Is there any coating that can be used to face the molds with, so that brass will run well, and produce good smooth castings in iron molds?—G. J. C.

9.—SCHOOL OF ENGINEERING.—I should be glad to find through the columns of the SCIENTIFIC AMERICAN, where a young man can most speedily acquire a knowledge of steam engineering; and if some of your numerous correspondents can point out some school in the Southern States where it is taught it will greatly oblige—A. T.

10.—LINSEED OIL VARNISH.—I find that linseed oil boiled properly with dryers makes an excellent varnish for either inside or outside work. In fact, for durability and gloss I think it equal to the best coach varnish, but boiling does not change the smell. Is there anything that can be put into it that will give it the smell of varnish?—G. W. F.

11.—ASPHALTING GARDEN WALKS AND STREET PAVEMENTS.—Under this heading, in your journal of the 31 of June last, taken from the "Gardener's Chronicle," are some directions for asphalting, which I must conclude are fallacious. The instruction is to mix quicklime, powdered, with gas tar, which I did, making the mixture about the consistency of putty, which I put away under the cover of a roof to harden. In about four weeks I had a light feathery pile of air slaked lime, discolored, of course, by the coal tar. The pile was so light that a breath of air might have scattered the whole, being lighter than ordinary air slaked lime. Will some one either set me right in my process, or state whether my doubts of the value of lime are well founded?—Pa.

12.—GIMLET POINTED SCREWS.—How are gimlet pointed wood screws cut? Is the cut made in one operation? Is the point cut by separate dies? Is the end pointed by shaving before the thread is cut?—I. H. D.

13.—STOVE FLUES FOR COTTON MILL.—What is the best arrangement for heating a three story wooden cotton mill with stoves? Two on each floor are required, so as to have as few openings for the exit of smoke as possible, and the least danger from fire. If an inside central flue to receive the pipes would answer the purpose, how, and of what material should it be constructed?—J. L. M.

14.—PUTTING UP FRUIT IN GLASS.—What is the best method for exhausting atmospheric air from glass jars, in order to preserve fruits and vegetables in them? The plan should not be expensive, as it is for the use of private families.—S. H. P.

15.—CEMENT.—I have a clay pipe in joints, and I want to put them together. What kind of cement, that will stand heat, shall I use? I have tried hydraulic cement, but it will not answer my purpose, as it cracks when subject to heat.—B. H. D.

16.—CONE PULLEYS.—I wish to find out, through "Answers to Correspondents," if it makes any difference how far apart two cone pulleys are placed, in order that the belt shall run equally tight on each pulley. I have been told that, if placed far apart, the belt would not run the same as it would if they (the pulleys) were placed close together, and that the sizes of the pulleys must be varied to suit their distance from each other.—G. A. B.

17.—STAINED MARBLES.—I have some furniture marbles stained by smoke from burning hay. I wish to know how to remove the stain without destroying the polish.—T. T. E.

18.—BLUEING.—How is cake blueing made? Is indigo, or some cheaper material, used?—I. H. D.

19.—WIND PROPELLER.—I have experimented as follows: An ordinary wind wheel, with arms at an angle of 45° to the plane of revolution, 8 inches in diameter, speed 204 revolutions in the air, propelled a boat (16 inches long, 4 inches wide, 4 inches deep over all, with Babbitt metal enough run in the hold to weigh it down so that it was under water amidships), at the rate of four miles per hour up stream in the Mississippi. This is further than paddle wheels would propel it, if driven by similar power with a clockspring. So much for experiment. My theory is this: When the wind turns a wind wheel with sails at an angle of 45°, with a power equal to ten horse power, it also exerts a force of ten horse power against the framework of the mill. Now then, if there be no wind, and a ten horse power engine is attached to the shaft to revolve the wheel as before, it will still exert that ten horse power against the framework, will it not? It will if action and reaction are equal. Now, I propose to run two such wheels side by side by a belt running over both of their pulleys and the driving pulley of the engine; the pulleys on the wind wheel shafts to be cone pulleys, set the small end of one opposite the large end of the other, so that shifting the belt would act as a steering apparatus by varying the relative velocities of the fans. I would like to know what your correspondents think about this.—F. S.

Declined.

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

COCOA NUT OIL, by G. R. P.
KNOW THYSELF, by ——.
QUARTER TWIST BELT, by N. F. D.
QUARTER TWIST BELT, by W. A. P.
IS THE NEBULAR HYPOTHESIS A THEORY? by C. L. F.
ELECTRICITY AND GALVANISM, by ——.
SILVER MINING, by H. C. A.

Recent American and Foreign Patents.

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

WHEAT CLEANER.—Emanuel Chipman, Baltimore, Md.—This invention consists in a machine for cleaning wheat by means of two or more sets of burrs placed one above another in a frame, each set of burrs being surrounded by a perforated case, and all the sets being inclosed in a trunk in the top of which, above the uppermost set of burrs, is a fan blower, the action of which produces an upward flow of air through the trunk and among the burrs, by which flow the dirt that is rubbed from the wheat between the burrs, and also between the burrs and cases, is carried upwards and discharged from the top of the trunk, the wheat passing from one set of burrs to another.

CORN PLANTER AND FERTILIZER DISTRIBUTOR.—Charles W. Barrick, Walkersville, Md.—This invention relates to sundry improvements in a machine for planting corn, and at the same time, distributing fertilizer, said improvements enabling the operator to govern the depth of the furrow, the depth of covering, the number of grains, and the quantity of fertilizer delivered to each hill, and the width of the interval between the rows.

SHINGLE MACHINE.—Franklin Muzzy, Bangor, Me.—This invention relates principally to an apparatus whereby the reciprocating carriage, which carries the shingle block forward against the saw and backward from it, is made to work automatically by throwing the pinion that drives the carriage out of gear therewith at the moment the shingle is severed from the block, and thus subjecting the carriage to the action of the weight which draws it back, and by throwing the aforesaid pinion into gear with the carriage at the moment the latter reaches the end of its backward movement, and thus causing the carriage to move forward again.

SAWING MACHINE.—Dr. Homer Bean, Fredonia, Ohio.—This invention relates to a machine for sawing wood into lengths suitable for stoves, furnaces, etc, including both a circular and a reciprocating saw, a portable frame bearing the operating mechanism, a cross frame, for sustaining the wood, hinged to the front end of the portable frame, a mechanism for raising and lowering the reciprocating saw, and a mechanism for throwing into operation or out of it, the feed roller on the hinged frame.

RAILWAY CONDUCTOR'S ELECTRIC TELEGRAPH APPARATUS.—Hugh S. L. Bryan, Liberty, Mo.—This invention has for its object to enable a railway conductor ignorant of the science of telegraphy to make use of the telegraph for the purpose of apprising the authorities at a designated station of any accident that may have happened to his train. To this end each train should be supplied with an electromagnetic apparatus provided with facilities for connecting with the telegraph wires that are stretched by the roadside, with which apparatus is connected the conductor's mechanism.

MODE OF MOLDING CIGARS.—John Charter, Sterling, Ill.—This invention consists in a new combination of suitably grooved and sliding blocks with sundry attachments and appendages whereby cigars may be molded in a convenient, expeditious, and perfect manner.

NAIL MACHINE.—A. W. Paull and John Morgan, Jr., Wheeling, West Va.—The peculiar feature of this invention consists in producing a straight sheer cut by causing alternate and reversely obliqued knives to move in a plane perpendicular to the plane of the nail plate.

BAG HOLDER.—T. J. Trapp, Williamsport, Pa.—This invention relates to a bag holder that can be adjusted to suit the openings of bags of different sizes, and that can be raised or lowered as may be necessary to accommodate bags of different lengths, and that is combined with a movable platform on which the bags rest while filling, which platform can be raised and lowered for the purpose of shaking down and consolidating the contents of the bags.

HARROW.—Benjamin Johnston, Sterling, Ill.—In this case the teeth of the harrow are all inclined backwards to prevent stalks, stubble, weeds, etc., from becoming impaled on them, but the invention particularly relates to the arrangement of parts by which, through the lateral movement of a lever, either half of the harrow may be raised from the ground, the two halves being hinged together.

HARVESTER.—William H. Harman, Westminster, Md.—This invention relates to a harvester wherein the axle of the transporting wheels transmits motion to the mechanism that operates the cutter bar whenever the first cog wheel of said mechanism is connected with the axle by means of a sliding clutch, said mechanism being rendered inoperative when the sliding clutch is thrown out of gear with the cog wheel and axle. The improvement relates particularly to the construction and arrangement of a draft or brace bar in reference to the finger bar, and to a swinging frame connecting it with the case inclosing the gearing and to the case itself.

THROTTLE VALVE LEVER.—In this improvement, invented by Charles E. Stewart, of Aspinwall, State of Panama, U.S., of Columbia, an eccentric acts upon the lever attached to the valve stem, the eccentric being actuated by a lever attached to the shaft of the same. The eccentric strap or band is made to bind upon the eccentric by a hand screw so as to lock the valve in any desired position. The object of the invention is to give greater control over the throttle valves of steam engines, by the increased power thus secured.

DEEP WELL PUMP.—T. S. Trapp, Williamsport, Pa.—This invention consists in a funnel shaped bottom applied to a deep well pump for the purpose of giving room for an orifice at the lower end of the pump, large enough to admit such a column of water as will fill the same, and for a valve of corresponding size to be used in connection with said orifice.

SEWING MACHINE.—John P. Sherwood, Fort Edward, N. Y.—This invention consists in a thread holder so constructed as to prevent the needle from catching in the thread or passing through kinks in the same, prior to entering the cloth; also in an oscillating vertical arm that gives motion beneath the bed plate to the connecting rod which operates the shuttle carrier, such arm being provided with a slot, each of whose sides is double beveled from a vertical central line outward, in combination with a friction roller on the wrist pin that projects from the side of the balance wheel and traverses such slot, the said roller being also double beveled from a central circumferential line towards each end for the purpose of reducing friction and giving room in which the wrist pin may rise and fall in the slot as the arm oscillates.

YARN HOOK.—Thomas Stibbs, Wooster, Ohio.—This invention relates to a mechanism for twisting skeins of yarn, preparatory to tying them into hanks, said mechanism consisting of a hook fixed on the end of a shaft supported in a suitable frame, and of a pulley placed loosely on said shaft, and driven independently of it, and of a clutch fixed on the shaft, by means of which, when the clutch, by moving the shaft endwise, is thrown into gear with the pulley, the shaft is rotated and the hook also, so that when the bight of a skein of yarn is placed on said hook the skein becomes twisted thereby, such twisting ceasing when the operator stops pulling on the skein, the clutch being then thrown out of gear with the pulley by means of a spring.

PROPELLER.—Keyes P. Cool, Glen's Falls, N. Y.—This invention relates to a propelling mechanism employing two cylinders, and intended to be placed in a horizontal position on the floor of the after cabin of a canal boat or other vessel, and in which the piston rods are directly connected with floats hung to the rear ends of said rods, said floats working in bottomless chambers built at the vessel's stern and open to the water, so that the moving of the floats sternward propels the boat forward, and the moving of the floats forward propels the boat sternward.

DREDGE.—Edwin Platt, Charleston, S. C.—This invention relates to a dredging apparatus, the lower end of which when at work rests always on the bottom of the body of water where it is employed, its upper end being connected with the boat, and the dredge having play enough to keep its lower end always on the bottom in all states of the tide; the apparatus being also provided with one wheel at the bow or stern of the boat for propelling her forward or backward, and with another wheel for turning the boat to either side.

CHURN POWER.—Benjamin F. Frampton, Punxsutawney, Pa.—This invention consists of an arrangement of parts whereby a churn dasher is operated by a descending weight, which latter, as it goes down, raises a lesser weight, that, when the first weight has completed its descent, goes down also, thus continuing the movements of the dasher till the second weight has completed its descent.

APPARATUS FOR OPERATING FANS.—William M. Bruton, Baltimore, Md.—This invention consists in an apparatus to be connected with a table for supporting a fan in such a manner that it may be vibrated sufficiently to create a breeze for the comfort of a person sitting by it, by means of a cord connecting the fan with a treadle and a counterspring to operate in opposition to the treadle.

DOOR STOP AND HOLDER.—Isaac J. Wells, Willmar, Minn.—This invention consists of a casting having a slanting upper surface, and secured to and resting upon springs that are to be fastened to a floor at a proper distance from the wall, said casting having a transverse notch in its upper side, in combination with a casting intended to be let into the bottom of a door crosswise of the same, and provided with a shoulder, which, when the door is swung open, glides up the incline of the floor casting until it enters the notch in the same, where it is held fast.

PADLOCK KEY.—This key is constructed with one set of bits upon the ends and another set upon the sides of its wards, so that it will first throw back one set of tumblers, and hold them while throwing back another set. The inventor is Edward L. Gaylord, of Bridgeport, Conn.

WHEELBARROW.—Harry Lawrence, of New York city.—This wheelbarrow is made with folding legs, sides, and ends, these parts being hinged to the frame of the body, and being, when in use, held by a system of slotted braces. This construction allows the wheelbarrow to be packed in close compass for storage or transportation.

STERN BEARING FOR PROPELLERS.—An enlargement of the bearing is made by means of a secondary bearing applied to an extension of the casting attached to the stern post for supporting the ordinary bearing, the said extension being let into a recess in the stern post surrounding the shaft. James Bolles, of New York city, is the inventor.

LADIES' WORK STAND.—A stationary circular top has under it a revolving top, carrying radial sector shaped tills, which are brought under a sector shaped lid in the upper top or leaf, whenever the tills are revolved on the standard of the workstand. A series of separate compartments easily reached is thus supplied, whereby the various articles used by ladies in sewing may be kept assorted, while at the same time a stand of graceful and ornamental design may be furnished. The upper end of the standard rises through the upper leaf, and supports a spool stand and emery bag. C. S. Caple, of Frankfort, N. Y., is the inventor.

WHEELBARROW.—Harry Lawrence, of New York city.—Our readers will find in another place in this department of the paper a notice of a wheelbarrow, with folding legs, sides and ends. The present improvement by the same inventor makes the wheel detachable from the axle, so that it can be laid down flat upon the folded barrow, thus still more reducing the space necessary for storage or transportation.

PHOTOGRAPHIC REFRIGERATOR.—This is designed to be a more convenient refrigerator for photographers' chemicals than those hitherto employed. The invention consists in a definite arrangement of compartments for the purpose specified. The inventor is Mrs. Mary A. Thornton, of Perrysburg, Ohio.

FRUIT CAN.—Leo C. Straub, of Pittsburgh, Pa.—This consists in the application of a moveable metallic collar to the neck of a fruit jar, the collar being so formed that it makes a channel for the reception of the wax used in sealing. The lower end of the cover enters into the channel, and the wax being poured in, the jar is thus sealed.

FRUIT DRYING APPARATUS.—This is the invention of Judson Allen, of Everett, Mo., and consists in an arrangement of a heater, hot air conducting pipes, and fruit drawers, in a wooden case having an apparatus for generating heat, and another for distributing the same uniformly to the fruit.

COMBINED CIDER MILL AND PRESS.—Orville M. Brock, Monroeton, Pa.—This invention constitutes a portable cider mill. It consists of sectional toothed grinding cylinders, having an appropriate hopper, and discharging the ground apples into a hoop, provided with a follower which is forced down by a screw to compress out the juice from the ground or crushed fruit. The crushing cylinders are driven by a winch and suitable gearing.

WAGON BRAKE.—This is the invention of Washington Bryant, of Batesvill, Ark., and has for its object the application of the resistance of the team in holding back to force down the brakes, and yet to allow the wagon to be backed freely, when desired. The brake shoes are applied to the wheels in such a manner that the forward motion of the wheels causes them to tighten against the tires, while the backward motion releases them, the application of the shoes, when the team holds back, being made through a system of levers and links actuated by a chain connected with the breast yoke.

ISODOROUS PORTABLE WATER CLOSET.—William Chapman, Mount Vernon, N. Y.—The vessel or chamber is made with a double wall at the top of this wall extending downward about one half the entire length, or sufficient to give, when filled, a water column of sufficient weight to prevent the escape of gases, when the annular space has water placed therein. A cap passes down into this annular space, thus forming a water seal like that used in gasometers. A valve is provided in the top of the cap or cover to allow the escape of air when the cap is introduced into the annular space above described. Both cap and cover are provided with suitable handles. This is a good invention, and will supply a want long felt in sick chambers.

WINDOW CURTAIN ROLLER.—William Gorton, New York city.—When the roller is of that class made of sheet metal—usually tin—it is so formed that the edges of the sheet lap each other snugly but are not connected, so that the hem on the upper end of the curtain may be slipped in between the lapped edges, or when the roller is made of wood, it is formed in halves, longitudinally, and a groove cut in one half for the reception of the hem.

EVENER.—Martin Terrill, Star Prairie, Wis.—This consists of a fixed crossbar, with pulleys at the ends, over which chains pass from the whiffletrees, to a horizontally oscillating T lever, so adjusted that when the horse pulls ahead, the leverage is changed to favor the hindmost horse.

STEAM PUMPING ENGINE.—This is an improvement in the mode of connecting the valves and valve seats with the pump, and in the arrangement and combination of parts, by which a very simple automatic valve motion is secured, in a compact and easily constructed form, and which is, in its various details, accessible and easily adjusted and repaired. Patrick Doyle, of New Comerstown, Ohio, is the inventor.

FLY WHEEL.—Charles Root, of Cleveland, Ohio.—This consists in the mode of attaching fly wheels to their shafts. A series of friction devices is employed, which hold the wheel firmly enough during any variation of power required in ordinary work, to act as an efficient regulator, but still admit the wheel to turn on the shaft, in case of sudden stoppage, thus relieving the machinery of the great strain to which it would otherwise be subjected in such cases.

RAILROAD SWITCH.—This is designed for horse railways. The switch is so constructed that it is actuated by a system of levers, controlled by a hinged plate, placed between the rails of the track upon which the horses step, their weight thus bringing the switch into the proper position. The inventor is T. Newman, of New Orleans, La.

LOCOMOTIVE HEAD LIGHT.—In this head light an external reflector is employed, having sides converging in straight lines to meet a concave surface at the back, which latter surface has in the center a depression or concave surface with a smaller radius than the first. Within this reflector is a smaller reflector, with an open end toward the concave surface of the first named outer one. The surfaces are so arranged with reference to each other that the light falling upon them from a lamp is reflected out in a beam of parallel rays, the larger portion of the rays suffering double reflection in order to bring them parallel to the others. The reflector is constructed on sound optical principles, as will be seen upon inspection. Invented by Charles S. Lee, and William M. Baldwin, of Troy, N. Y.

APPARATUS FOR REMOVING AND REPLACING WAGON BODIES.—This consists of two rollers, one for the forward end, and one for the back end of the wagon body, one of them having a hand wheel, and both being adjusted in a suitable frame attached to the timbers on the roof or upper floors of wagon sheds. Ropes are attached to the wagon body at the ends, one passing down directly from the hand wheel roller, and the other passing back from the same over the rear roller, so that both are wound or unwound simultaneously and the wagon body is raised or lowered in a horizontal position.—T. R. Vestal, Santa Fe, Tenn., is the inventor.

CIRCULAR SAW MILL.—Samuel M. Palmer, of Glen's Falls, N. Y.—To each end of the mandrel is attached a pulley, one or both of which is detachably attached to the said mandrel, by means of a screw thread cut upon the said mandrel, and upon the inner surface of the said pulley, or in any other convenient manner, so that the said pulley or pulleys can be readily removed when required to enable the saws to be detached from said mandrel. By this arrangement, the saws are driven by power applied to both ends of the mandrel instead of by power applied to only one end, as is the usual construction. The lower feed rollers are grooved, and their journals revolve in bearings attached to the frame. Should the feed rollers encounter any obstruction, a friction disk slides upon a friction wheel until the machine can be stopped, thus guarding against breakage of the feed mechanism.

ELECTRIC CAR BRAKE.—The lever system of the brakes is actuated by chains which are wound upon a shaft driven by a belt from a pulley on one of the car axles, which belt only operates when tightened through the agency of electromagnetism, which raises the winding shaft in slotted bearings, and thus puts the belt under tension. The inventor is HENRY F. DAGGETT, of La Fayette, Ind.

SETTING STEAM BOILERS.—The object is to facilitate the draft and the application of heat to the boilers. The invention consists in graduating the arch and the breeching from the fire door to the smoke stack. The inventor proposes to arrange the grate and the bottom of the arch behind it on a gradual and uniform ascending incline from the mouth to the rear, and to incline the wall towards the boilers in the same manner; also, to graduate the capacity of the breeching, beginning on the side of the most distant boiler from the smoke stack discharging into it towards the smoke stack, according to the volume discharging into it, or the sum of the areas of the flues discharging into it which arrangement, together with the smoke stack made considerably greater than the area of the boiler flues and the arch, has the effect of making the draft much more apid from the fire through the arch and flues, and thereby very greatly increases the steam generating capacity also the capacity to burn wet fuel, such as green tan bark and the like.—Orrin Ranney, of Corry, Pa., is the inventor.

MEDICAL COMPOUND.—Abram M. Loryea, East Portland, Oregon.—This is a new compound for the treatment of rheumatism, in which the essential ingredient is the unkweed, supposed to be *Thaspium cordatum*, of Oregon which the inventor styles "the unkweed remedy."

CORN SHELLER.—Asahel Patch, of Hamilton, Mass.—This is a new combination of familiar devices, by which the inventor claims to have secured a more efficient machine than has hitherto been used for the purpose specified. The parts are extremely few and simple, and the machine is unusually compact. We judge it will find favor among practical men.

FOLDING EASEL.—This is a construction of an easel whereby it folds together very compactly in a flat and limited space, a great convenience to painters while making sketching tours, as well as in schools, lecture rooms, etc.—The inventor is Rufus Wright, of Brooklyn, N. Y.

WASHING MACHINE.—M. Van Auken, Utica, N. Y.—A swinging segmental ribbon moves in a semicylindrical case, having ribs upon the bottom, the rubber being also provided with ribs. The arms upon which the pendant rubber swings do not admit the ribs upon it to come in contact with the bottom ribs, but the surface of the rubber approaches the ribbed bottom more closely at the ends of its stroke than at the middle, so that the clothes are squeezed as well as rubbed.

CARVING AND MOLDING MACHINE.—M. F. Boult, Battle Creek, Mich.—This excellent machine was illustrated and described elaborately on page 251, Vol. XIII. of the SCIENTIFIC AMERICAN. The present patent is for improvement, in mechanism and cutters upon the machine, as there described, which add to its utility, but in no way affect the general character or principle of the machine.

CARBURETERS FOR GAS AND AIR.—Matthias P. Coons, of Brooklyn, assignor to himself, Philip Dater, of New York city, and Charles N. Ayres, of Brooklyn, N. Y.—This invention has for its object to provide a simple cheap, and efficient gas or air carbonizer or carbureter, which will be perfectly safe against explosion in cases of fire or ignition by careless treatment or design, except at the ignition point of the burner; also, to provide an efficient and reliable means of supplying air and maintaining the requisite pressure when air is used. The invention consists in certain improvements in the arrangement of the air and gas mixing apparatus; also, in improved absorbent material employed for taking up the hydrocarbon and exposing it to the air or gas; also, an improved safety filling apparatus; also, an improved jacket of fireproof and non-heat-conducting substance for the preservation of the carbureting chamber, and regulation of the temperature of the same; and also, an improved apparatus for injecting the air. The absorbing substance is preferably woolen cloth and hair prepared in balls for taking up the hydrocarbon or the gas and holding it for the more perfect combination with the air.

CULTIVATOR TOOTH.—Michael F. Lowth and Orlean H. Porter, Wabasha, Minn.—This invention relates to a cultivator tooth that is suspended at its upper end in the beam, the shank of the tooth being provided with a brace that extends backwards and upwards through the beam, the improvements having for their object to enable the teeth to yield to obstructions when drawn forward, and to prevent the teeth from swinging forward when the cultivator is drawn back.

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116,789.—FRUIT GATHERER.—G. Aldridge, Henderson city, Ky
116,790.—HUB CENTER MACHINE.—K. P. Allen, Homer, Mich.
116,791.—LAWN MOWER.—W. Allen, Worcester, Mass.
116,792.—HEATER.—J. Argall, Mineral Point, Wis.
116,793.—MUSICAL INS.—T. Atkins, H. Drewer, Cincinnati, O.
116,794.—BRUSH.—B. F. Averill, Dunkirk, N. Y.
116,795 —JOURNAL BOX.—B. C. Baker, Toledo, Ohio.
116,796.—STEAM GENERATOR.—G. A. Barnard, New York city.
116,797.—TABLE, ETC.—D. K. Barnhart, Gaines, Pa.
116,798.—CIDER MILL.—W. Barr, Ypsilanti, Mich.
116,799.—ADVERTISING MEDIUM.—J.O.Belknap, N.Orleans, La.
116,800.—DOOR SPRING.—A. T. Boon, L. Mills, Galesburg, Ill.
116,801.—CAR COUPLING.—J. H. Bull, Hereford, Md.
116,802.—ICE RUN.—G. Burhans, Rondout, N. Y.
116,803.—EVAPORATOR.—F. G. Butler, Bellows Falls, Vt.
116,804.—STOCK CAR.—J. B. Calkins, Pacific, Mo.
116,805.—GAGE, ETC.—F. Castle, Montana.
116,806.—ANCHOR.—C. A. Chamberlin, Pittsburgh, Pa.
116,807.—CUTLERY REST.—L. J. Cherrington, Boston, Mass.
116,808.—OIL CAN.—P. Childs, Northampton, Mass.
116,809.—SEWING MACHINE.—J. C. Cochran, Ripley, Ohio.
116,810.—VENT BUNG.—B. R. Cole, Buffalo, N. Y.
116,811.—FOLDING CHAIR.—N., C.O., A.Collignon, Closter, N.J.
116,812.—GRATE BAR.—H. Collinson, Boston, Mass.
116,813.—BABY WALKER, ETC.—L. O. Colvin, Newark, N. J.
116,814.—CAR BRAKE.—J. R. Crabill, La Crosse, Ill.
116,815.—BED BOTTOM.—D. V. Crandall, Chicago, Ill.
116,816.—WATCH CHAIN.—C. Croselmire, Newark, N. J.
116,817.—MILL PICK.—J. Cummings, West Charleston, Vt.
116,818.—CAR BRAKE.—H. S. Daggett, La Fayette, Ind.
116,819.—BILLIARD CUSHIONS.—M. Delaney, New York city.
116,820.—VALVE.—T. Draper, Petrolia, Canada.
116,821.—SOAP.—F. M. Ellis, Brooklyn, N. Y.
116,822.—CARPET PROTECTOR.—H. W. Eskildson, Boston, Mass.
116,823.—TUBE CLEANER.—P. Farley, Philadelphia, Pa.
116,824.—COPYING PRESS.—J. Fensom, Toronto, Canada.
116,825.—TREATING RUBBER, ETC.—P. Finley, New York city.
116,826.—TELEGRAPH.—D. Flanery, New Orleans, La.
116,827.—CORN PLANTER.—J. T. Foree, Henry county, Ky.
116,828.—SHOE.—C. C. Geller, Albany, N. Y.
116,829.—FURNACE.—G. and B.J.Goodsell, and John Been, Jr., Pentwater, Mich.
116,830.—SEWING MACHINE.—J. W. W. Gordon, Newport, Ky.
116,831.—RAILWAY SIGNAL.—W. Green, Yonkers, N. Y.
116,832.—COOK STOVE.—S. Gregory, South Norwalk, Conn.
116,833.—CARPET SWEEPER.—D. C. Hall, Hannibal, Mo.
116,834.—MUSICAL INSTRUMENT.—E.Hamlin, Winchester, Ms.
116,835.—CAN FOR ROVING.—E. Haskell, Dover, N. H.
116,836.—BOILER.—S. J. Hayes, E. T. Jeffery, Chicago, Ill.
116,837.—BORING BIT.—D. Kelly, Muskegon, Mich.
116,838.—MARKER.—F. B. Kendall, Monmouth, Ill.
116,839.—DRAIN PIPE.—C. W. Kennedy, Brooklyn, N. Y.
116,840.—FEED REGULATOR.—R. Kitson, Lowell, Mass.
116,841.—WASTE PICKER.—R. Kitson, Lowell, Mass.
116,842.—PAPER BAG MACHINE.—M. E. Knight, Boston, Mass.
116,843.—HORSE POWER.—F. M. C. Liles, Roanoke, Ala.
116,844.—BUTTER KETTLE.—J. Liming, Philadelphia, Pa.
116,845.—ROOFING BRACKET.—J. H. Look, Jr., Rochester, Mass.
116,846.—MEDICAL COM.—A. M. Loryea, East Portland, Ore.
116,847.—RATCHET DRILL.—J. W. Mahlon, Brooklyn, N. Y.
116,848.—RATLIN.—J. P. Manton, Providence, R. I.
116,849.—HOUSE IMPLEMENT.—R. A.McCauley, Baltimore, Md.
116,850.—SOFA.—J. W. McDonough, Chicago, Ill.
116,851.—HINGE, ETC.—A. D. McMaster, Rochester, N. Y.
116,852.—CONVERTING RESIDUUM.—C. C. Mengel, Brooklyn, N. Y., and A. P. Von Pöhrnhoff, St. Catharine's, Canada.
116,853.—STEAM PISTON.—E. Merriman, Allegheny, Pa.
116,854.—WATER GATE.—D. J. Moffit, Thorntown, Ind.
116,855.—CHURN.—O. F. Monfort, Dearborn, Mich.
116,856.—CRADLE.—T. W. Moore, New York city.
116,857.—GALLEY REST.—J. M. Murphy, Olympia, Wash. Ter.
116,858.—WATCH CHAIN.—D. F. Myers, New York city.
116,859.—LIQUID METER.—H. B. Nickerson, Boston, Mass.
116,860.—TASSEL.—James Norman, Brooklyn, N.Y.
116,861.—INVALID BEDSTEAD.—M.A.Ormsbee, Fair Haven, Vt.
116,862.—BRACKET.—G. W. Pierce, Boston, Mass.
116,863.—MEDICAL COMPOUND.—M. E. Perrin, Montreal, Can.
116,864.—CHIMNEY CAP.—W. J. Pettingell, Lowell, Mass.
116,865.—AMALGAMATING GOLD.—I. M. Phelps, Chicago, Ill.
116,866.—STOCK CAR.—Amos Rank, Salem, Ohio.
116,867.—TRIMMING MACHINE.—T.K.Reed, E.Bridgewater, Ms.
116,868.—SHEARS, ETC.—R. and A. Renz, Naugatuck, Conn.
116,869.—HAY PRESS.—W. H. Reynolds, New Orleans, La.
116,870.—SWIVEL HOOK.—C. E. Richards, N.Attleboro', Mass.
116,871.—CHURN.—J. L. Rust, Keithburg, Ill.
116,872.—BOOT AND SHOE.—F. Senn, Forestville, N.Y.
116,873.—BLAST PROTECTOR.—J. H. Setchel, Cincinnati, O.
116,874.—KNAPSACK.—C.W. Schaefer, Philadelphia, Pa.
116,875.—MEDICAL COMPOUND.—A. F. Shannon, Quincy, Ill.
116,876.—EXCAVATOR.—G. F. Sheffield, Boston, Mass.
116,877.—SAWING MACHINE.—Ira Shepard, Dowagiac, Mich.
116,878.—FASTENER.—H.Smiley, W.T.Loughead, Boston, Mass.
116,879.—MUSICAL INSTRUMENT.—K. Smith, Lowell, Mass.g.
116,880.—SCREW MACHINE.—L.Southworth, Jr., S.G.Cushin Stoughton, Mass.
116,881.—FLIER FOR SPINNING, ETC.—T. Stibbs, Wooster, O.
116,882.—ELASTIC SUPPORTER.—G. C. Stillson, Derby, Conn.
116,883.—WELL AUGER.—W. H. Stone, Pattonsburg, Mo.
116,884.—MEMORANDUM BOOK.—I. N. Swasey, Yonkers, N.Y.
116,885.—SHEARING MACHINE.—F.W. Tally, M. Ryan, Phila.
116,886.—LEATHER.—Z. A. Taylor, Haverhill, Mass.
116,887.—CHIMNEY COWL.—G. G. Thomas, St. Louis, Mo.
116,888.—SHOVEL, ETC.—J. Thompson, Decatur, Mich.
116,889.—SAFETY SHAFT.—J. S. Tibbets, Brazil, Ind.
116,890.—PIPE CUTTER.—G. W. Tower, Cambridge, Mass.
116,891.—CAR BASKET RACKS.—M. Tower, Boston, Mass.
116,892.—INKING APPARATUS.N.F.Turner, Williamsburg, N.Y.
116,893.—SEWING MACHINE.—S.S.Turner, Westborough, I. S. Craig, Boston, Mass.
116,894.—POTATO BUG DESTROYER.—J.B.Turney, Inkster, Mich.
116,895.—BATHING APPARATUS.—C. B. Veronee, Athens, Ga.
116,896.—PITCHING BARRELS.—W. Vogt, Louisville, Ky.
116,897.—SOAP.—D. H. Warren, Montreal, Canada.
116,898.—THILL COUPLING.—Edward Warren, Ceresco, Mich.
116,899.—UMBRELLA.—Walter Watson, Fayetteville, N. C.
116,900.—STOVEPIPE DRUM.—B.Webster, Kingfield, Me.
116,901.—COUNTERSINKS.—Asa Wheeler, Brattleborough, Vt.
116,902.—STEAM ENGINE.—J. D.Whelpley, Boston, Mass.
116,903.—ORES.—J. D. Whelpley, J. J. Storer, Boston, Mass.
116,904.—HARNESS TRIMMING.—S.Wiener, Newark, N. J.
116,905.—COOKING STOVE.—John Wilder, Detroit, Mich.
116,906.—HEALING PLASTER.—D. G. Williams, Boston, Mass.
116,907.—LOCK.—J. T. Williams, Chicago, Ill.
116,908.—HOT AIR FURNACE.—C. Wood, Worcester, Mass.
116,909.—STEAM CONDENSER.—W. Wright, New York city.
119,910.—WAGON BRAKE.—J. J. Adgate, Stevensville, N.Y.
116,911.—TWINE HOLDER.—John Adt, New Haven, Conn.
116,912.—FRUIT JELLIES.—Charles Alden, Newburg, N.Y.
116,913.—WATCH KEY, ETC.—J.P.Allen, H.Croft, Springfield, O.
116,914.—CAR HEATER.—J. G. Allen, Philadelphia, Pa.
116,915.—SAWING MACHINE.—G. F. Almy, Toledo, O.
116,916.—HOIST.—J. R. Anderson, P. C. Harlan, Freeport, Pa.
116,917.—BATTERY LIQUID.—V. Barjon, New York city.
116,918.—BRONZING MACHINE.—E. F. Benton, Buffalo, N.Y.
116,919.—FAN ATTACHMENT FOR TABLES.—T. S. Binkard and R. H. Boal, Urbana, Ohio.
116,920.—PIPE MACHINE.—H. Bissell, Hartford, Conn.
116,921—BOOT SOLES.—L. R. Blake, Fort Wayne, Ind.
116,922.—SCREW MACHINE.—E. C. Blakeslee, Waterbury, Ct.
116,923.—METAL CUTTER.—S. A. Bostwick, Waltham, Mass.
116,924.—COTTON GIN.—W. F. Bowen, Stark, Fla.
116,925.—BALING HOOPS.—G. Brodie, Plumb Bayou, Ark.
116,926.—GLASS PRESS.—A. P. Brooke, New York city.
116,927.—STOVE.—L. A. Brooks, La Porte, Mich.
116,928.—TELEGRAPH.—H. S. L. Bryan, Liberty, Mo.
116,929.—CURTAIN FIXTURE.—C. Buckley, Meriden, Conn.
116,930.—MOLDING CIGAR.—John Charter, Sterling, Ill.
116,931.—TIN BOX.—J. R. Cole, New York city.
116,932.—VISE.—A. Crease, Cleveland, Ohio.
116,933.—PAPER PULP.—C. M. Cresson, Philadelphia, Pa.
116,934.—CHAIR FOR BOATS.—R. H. Cutter, Cleveland, Ohio.
116,935.—SKATE.—C. T. Day, Newark, N. J.
116,936.—SHEARS, ETC.—S. W. Eastren, Tremont, N. Y.
116,937.—WATER WHEEL.—D. Ehrhart, Bel Air, Md.
116,938.—SHOE.—L. Elliott, Jr., New Haven, Conn.
116,939.—SHAFT COUPLING.—J. F. Emmert, Waynesboro', Pa.
116,940.—CHURN.—F. M. English, Evansville, Ind.
116,941.—ATTACHING KNOBS.—W. A. Fenn, Rochester, N. Y.
116,942.—BRICK MACHINE.—A. Ferguson, D. Ralston, George Hildreth, Troy, N.Y.
116,943.—APPLE PARER, ETC.—C. A. Foster, Fitchburg, Mass.
116,944.—ELECTRIC APPARATUS.—S. Gardiner, Jr., New York.
116,945.—BRIDLE BIT.—A. Gilliam, Pittsburgh, Pa.
116,946.—SADDLE.—A. Gilliam, Pittsburgh, Pa.
116,947.—SEWING MACHINE.—C.Goodyear, Jr., N.Rochelle, N.Y
116,948.—PAPER COLLAR.—S. S. Gray, Boston, Mass.
116,949.—WATER PIPE.—J. R. Griffin, Waterdown, Conn.
116,950.—BILLIARD TABLE.—L. A. Grill, New York city.
116,951.—BILLIARD FABRIC.—L. A. Grill, New York city.
116,952.—JOURNAL BOX.—H. Grogan, Flatbush, N. Y.
116,953.—LAMP REFLECTOR.—J.W.Haines, Cambridge, Mass.
116,954.—SAFE.—E. K. Hall, Louisville, Ky.
116,955.—RATCHET DRILL.—I. S. Hamilton, Hamilton, Ohio.
116,956.—PLOW.—W. Hay, T. B. Freeman, Hillsborough, Ore.
116,957.—WAGON BRAKE.—D. Healy, South Danville, N. Y.
116,958.—CARPET BEATER.—J.Hothersall, J.Banks, New York.
116,959.—SHOE.—G. C. How, Haverhill, Mass.
116,960.—GATE.—E. Howard, Milford, Mass.
116,961.—CAR WHEEL.—L. B. Hunt New York city.
116,962.—DRAFT REGULATOR.—A. L. Ide, Springfield, Ill.
116,963.—THILL COUPLING.—J. H. Jennings, New Bedford, Ms.
116,964.—BALE TIE.—C. G. Johnsen, New Orleans, La.
116,965.—HAY PRESS.—D. Knowles, Philadelphia, Pa.
116,966.—SKID, ETC.—J. M. Lane, South Norwalk, Conn.
116,967.—STENCH TRAP.—S. Lawrence, New York city.
116,968.—GOVERNOR.—B. S. Lawson, Brooklyn, N. Y.
116,969.—PRESERVING WOOD, ETC.—F. Lear, St. Louis, Mo.
116,970.—SALT.—R. G. Leckie, Acton Vale, Canada.
116,971.—WASHING MACHINE.—W. Lewis, Webster, N. Y.
116,972.—PADLOCK.—O. D. Madge, Washington, D. C.
116,973.—METALLIC HEEL.—A. S. Mann, St. Louis, Mo.
116,974.—PLANT PROTECTOR.—I. Mayfield, Mayfield, Ky.
116,975.—RAILROAD RAIL.—A.McKenney, Maumee City, Ohio.
116,976.—PRESERVING EGGS.—J. T. McKinn, Remington, Ind.
116,977.—PADLOCK.—J. H. McWilliams, New York city.
116,978.—PULP ENGINE.—H. B. Meech, Fort Edwards, N. Y.
116,979.—PAPER PULP.—H. B. Meech, Troy, N. Y.
116,980.—PAPER PULP.—H. B. Meech, Troy, N. Y.
116,981.—BAG HOLDER.—C. K. Mitchell, Greenville, Mich.
116,982.—WATCH KEY.—J. L. Moore, Bridgeport, Conn.
116,983.—ROOFING COMPOUND.—H. Morrie, Rockford, Ill.
116,984.—LAMP.—T. H. Mott, New York city.
116,985.—SHINGLE MACHINE.—F. Muzzy, Bangor, Me.
116,986.—CHAIN LINK.—E. Meyers, Creagerstown, Md.
116,987.—CORN SHELLER.—G. & H.O'Connor, Mishawaka, Ind.
116,988.—SHINGLE MACHINE.—O.A.Olmsted, Sebastopol, Cal.
116,989.—FENCE.—P. C. Pearson, Louisville, Ky.
116,990.—BOLT HEAD.—J. Plunkett, New York city.
116,991.—ROTARY HARROW.—R. Rakestraw, Wyoming, Ill.
116,992.—COOKING STOVE.—A. J. Redway, Cincinnati, Ohio.
116,993.—HARNESS.—S. Reynolds, Pittsburgh, Pa.
116,994.—HYDROCARBON GAS.—F. A. Sabbaton, Troy, N. Y.
116,995.—FISH NURSERY.—R. E. Sabin, W. Springfield, Mass
116,996.—CURTAIN FIXTURE. L. L. Sawyer, San Francisco, Cal.
116,997.—COATING COMPOUND.—J. Schultz, New York city.
116,998.—SEED TUBE.—L. Scofield, Watertown, Wis.
116,999.—WEIGHING SCALES.—G. Scott, Montreal, Canada.
117,000.—THIMBLE SKEIN.—A. L. Shears, St. Louis, Mich.
117,001.—WINDOW BLIND.—S. M. Sherman, Fort Dodge, Iowa.
117,002.—SEWING MACHINE. J.P. Sherwood, Fort Edward, N.Y.
117,003.—MEAT CUTTER, ETC.—A. R. Silver, Salem, Ohio.
117,004.—WAGON.—J. Skeen, Mound City, Ill.
117,005.—ANIMAL TRAP.—B. C. Smith, Pekin, Ill.
117,006.—STOVE.—D. Smith, Albany, N. Y.
117,007.—FIRE ESCAPE.—G. C. Smith, F. M. Burrows, Baltimore, Md.
117,008.—FLUE CLEANER.—C. H. Stebbins, Circleville, Ohio.
117,009.—GRATE.—E. F. Steele, Wallingford, Conn.
117,010.—FRICTION PULLEY.—J. Steger, New York city.
117,011.—CORN HUSKER.—J. Stengel, Croton, C. C. Davey Big Prairie, Mich.
117,012.—CHAIR.—V. Stockton, Williamsburg, Ohio.
117,013.—ICE BAG.—S. Stroock, New York city.
117,014.—END GATE.—J. L. Stropes, Bloomfield, Ind.
117,015.—ENVELOPE.—M. Taylor, Buffalo, N. Y.
117,016.—SAFE DOOR.—W. Terwilliger, New York city.
117,017.—LOG ROLLER.—J. Torrent, Muskegon, Mich.
117,018.—MATTRESS, ETC.—W. H. Towers, Boston, Mass.
117,019.—DEEP WELL PUMP.—T. J. Trapp, Williamsport, Pa.
117,020.—PANELING MACH.—D.F.Walker, Minneapolis, Minn.
117,021.—EQUALIZER.—L. Warren, Dwight, Ill.
117,022.—BUTTER WORKER.—W. Weaver, Phœnixville, Pa.
117,023.—LATCH, ETC.—S. H. Wheeler, Dowagiac, Mich.
117,024.—PLOW.—E. Wiard, Louisville, Ky.
117,025.—TELEGRAPH.—A. M. and M. A. Wier, London, Eng
117,026.—TABLE BELL.—H. C. Wilcox, West Meriden, Conn
117,027.—COTTON PRESS.—U. T. Wilson, Independence, Miss
117,028.—ADJUSTABLE DAM.—J. A. Wood, Pittsburgh, Pa.

REISSUES.

4,464.—HARROW TEETH.—J. F. Chase, Westbrook, Me.—Patent No. 113,141, dated March 28, 1871.
4,465.—Division A.—CAR BRAKE.—W. H. Dunham, Hokah, Minn., J. Widney, Allegheny, Pa.—Patent No. 71,591, dated Dec. 3, 1867.
4,466.—Division B.—BRAKE SHOE.—W. H. Dunham, Hokah, Minn., J. Widney, Allegheny, Pa.—Patent No. 71,591, dated Dec. 3, 1867.
4,467.—BOILER.—W. B. Scaife, Pittsburgh, Pa.—Patent No 107,817, dated Sept. 27, 1870.
4,468.—DRYING FRUITS, ETC.—F. H. Smith, Baltimore, Md.—Patent No. 31,566, dated Feb. 26, 1861; reissue No. 3,017, dated June 30, 1868.
4,469.—GRAPE TRELLIS.—T. G. Yeomans, Walworth, N. Y Patent No. 84,154, dated Nov. 16, 1868.

DESIGNS.

5,096.—YOKE.—D. Appel, Cincinnati, Ohio.
5,097.—CENTER PIECE.—C. Autenrieth, Philadelphia, Pa.—
5,098.—BOOT, ETC.—A. O. Bourn. Providence, R. I.
5,099 to 5,101.—STOCKING FABRIC. C. Button, Philadelphia, Pa.
5,102.—TABLE CUTLERY.—F. R. Chapman, Greenfield, Mass.
5,103.—PICTURE FRAME.—L. L. Dennick, Chicago, Ill.
5,104.—MUFF.—W. Ettinger, New York city.
5,105.—BRACKET.—W. D. Gridley, New Haven, Conn.
5,106 and 5,107. SHAWL FABRIC. J. Hodgson, Philadelphia, Pa
5,108.—CARPET PATTERN.—H. S. Kerr, Philadelphia, Pa.
5,109.—CARPET PATTERN —J. Magee, New York city.
5,110 and 5,111.—MAT.—J. Magee, New York city.
5,112 to 5,116.—OIL CLOTH.—C. T. Meyer, Lyon's Farm, N J.
5,117.—BELL TOWER.—T. W. H. Moseley, Hyde Park, Mass.
5,118.—BLACKING BOX.—D. O'Leary, Hubbard, Ohio.
5,119.—CARPET PATTERN.—T. Pennell, Morrisania, N. Y.
5,120.—VASE.—M. L. Snow, West Sterling, Mass.
5,121 to 5,126.—CARPET PATTERN.—G. C. Wright, New York

TRADE-MARKS.

370 and 371.—WHISKY.—Capel & Roebuck, Cincinnati, Ohio.

FOR THE WEEK ENDING JULY 18, 1871.

117,029.—FRUIT DRYER.—J. Allen, Everett, Mo.
117,030.—EVAPORATOR.—A. J. Andrews, Linden, Mich.
117,031.—LOCOMOTIVE.—W. D. Arnett, Denver, Colorado.
117,032.—RELISHING MACHINE.—D.G.Arnold, Winona, Mich.
117,033.—HAY LOADER.—H. Baker, Cortland, N. Y.
117,034.—CULTIVATOR.—P. O. Baldwin, Spring Lake, Mich.
117,035.—WATER METER.—J. S. Barden, Providence, R. I.
117,036.—SPRING BED.—B. Barstow, Westfield, Mass.
117,037.—CURTAIN FIXTURE.—J. E. Baum, Philadelphia, Pa.
117,038.—CURTAIN FIXTURE.—J. E. Baum, Philadelphia, Pa.
117,039.—STERN BEARING.—James Boiles, New York city.
117,040.—SHAKER.—W. H. and P. Bott, West Manchester, Pa.
117,041.—CIDER MILL.—O. M. Brock, Monroeton, Pa.
117,042.—TRUSS BRIDGE.—J. Burke, Saginaw, Mich.
117,043.—PRESS.—John T. Burr, Brooklyn, N. Y.
117,044.—WORK STAND.—C. S. Caple, Frankfort, N. Y.
117,045.—WATER CLOSET.—W.Chapman, Mount Vernon, N.Y.
117,046.—CLAW BAR.—David Christie, Chillicothe, Ohio.
117,047.—IRON BRIDGE.—T. C. Clarke, A. Bonzano, Phila., Pa.
117,048.—IRON BRIDGE.—T. C. Clarke, A. Bonzano, Phila., Pa.
117,049.—IRON BRIDGE.—T. C. Clarke, A. Bonzano, Phila., Pa.
117,050.—IRON BRIDGE.—T. C. Clarke, A. Bonzano, Phila., Pa.
117,051.—PROPELLER.—K. P. Cool, Glen's Falls, N. Y.
117,052.—EVAPORATING BRINE.—L. R.Cornell, Syracuse, N.Y.
117,053.—FIREPLACE.—M. A. Cushing, Aurora, Ill.
117,054.—PLOW.—D. C. Day, San Jose, Cal.
117,055.—HARVESTER.—G. E. Deardorff, Canal Dover, Ohio.
117,056.—CHAIR.—W. Donoghue, Philadelphia, Pa.
117,057.—GALVANIC BATTERY.—L. Drescher, New York city
117,058.—COTTON GIN.—J. Du Bois, Greensborough, Ala.
117,059.—CAR STOVE.—J. T. Evens, St. Louis, Mo.
117,060.—PASTING PAPER.—B. F. Field, Beloit, Wis.
117,061.—PACKING BOX.—John H. Foster, Chicago, Ill.
117,062.—VAULT LIGHT.—J. C. French, Chicago, Ill.
117,063.—VAULT LIGHT.—J. C. French, Chicago, Ill.
117,064.—PADLOCK.—E. Gaylord, Bridgeport, Conn.
117,065.—MEDICINE.—Margaret N. George, Evansville, Ind
117,066.—TABLE STAND.—John Gibson, Jr., Albany, N.Y.
117,067.—CAR COUPLING.—J. W. Gillam, Newton, N. J.
117,068.—CURTAIN ROLLER.—W. Gorton, New York city.
117,069.—SHIRT STUD.—J. G. Griswold, Hartford, Conn.
117,070.—CHURN.—G. Groom, Brockville, Canada.
117,071.—PISTON PACKING.—T. Hanson, New York city.
117,072.—ANIMAL TRAP.—E.Hause, L.Kelley, Tecumseh, Mich
117,073.—WINDLASS.—O. P. Hix, Rockland, Me.
117,074.—FEEDER.—N. Hoggatt, Madison Parish, La.
117,075.—CIDER PRESS.—J. Holbrook, Sherburne, Mass.
117,076.—VENTILATOR.—J. L. Howard, Hartford, Conn.
117,077.—RIM FOR WHEELS.—L. Hubbard, Ottawa, Ohio.
117,078.—GAITER SHOE.—F. H. A. Hussey, Lynn, Mass.
117,079.—HARROW, ETC.—S. Hutchinson, Griggsville, Ill.
117,080.—DOOR.—W. C. James, Fishersville, N. H.
117,081.—PEG SHARPENER.—A. Kehl, Indianapolis, Ind.
117,082.—BORING TOOL.—J. J. Kraus, Menasha, Wis.
117,083.—MOLDING MACHINE.—I. L. Lamb, Darien, Wis.
117,084.—PENCIL.—R. Lanstrom, Cincinnati, Ohio.
117,085.—WHEELBARROW.—H. Lawrence, New York city.
117,086.—WHEELBARROW.—H. Lawrence, New York city.
117,087.—MAKING ICE.—C. P. Leavitt, New York city.
117,088.—PRINTING PRESS.—T. Leavitt, Everett, Mass.
117,089.—REFLECTOR.—C. S. Lee, W. M. Baldwin, Troy, N.Y.
117,090.—SCHOOL DESK.—J. Long, E. Convers, Oswego, N. Y.
117,091.—FLANGING MACHINE. S.Lowen, Temperanceville, Pa.
117,092.—CULTIVATOR.—M.F.Lowth, H.Porter, Wabasha, Min.
117,093.—STRAINER.—R. and S. Mason, Burgh Hill, Ohio.
117,094.—LIQUID METER.—J. Mead, Charlestown, Mass.

117,095.—CUTTING MACHINE.—J. Meinig, Cincinnati, Ohio.
117,096.—COOKING RANGE.—E. Mingay, Boston, Mass.
117,097.—BRICK MACHINE.—A. F. Mitchell, Valparaiso, Ind.
117,098.—DRAWING FRAME.—B. Moon, Coventry, R. I.
117,099.—STEAM TRAP.—G. R. Moore, Philadelphia, Pa.
117,100.—BUTTON HOLE CUTTER.—W. A. Morse, Phila., Pa.
117,101.—SEWING MACHINE.—Carl Necker, Berlin, Prussia.
117,102.—WASHING MACHINE.—P. Nichols, Troy, N. Y.
117,103.—ARM REVOLVING SHELF.—P. Nichols, Troy, N. Y.
117,104.—ROOF.—N. G. Northup, Bloomington, Minn.
117,105.—CORN SHELLER.—C. M. O'Hara, Cincinnati, Ohio.
117,106.—CAMERA.—C. W. Parker, Watkins, N. Y.
117,107.—SPOOL CASE.—W. S. Phillips, Chicago, Ill.
117,108.—STEAM ENGINE.—O. M. Pike, Chicopee, Mass.
117,109.—DREDGING MACHINE.—E. Platt, Charleston, S. C.
117,110.—KEY.—Titus Powers, New York city.
117,111.—HEATER.—F. H. Pulsifer, Auburn, N. Y., and W. C. Wheeler, Baltimore, Md.
117,112.—COCK.—Joshua Regester, Baltimore, Md.
117,113.—STEAM PLOW.—Z. Rider, Painesville, Ohio.
117,114.—JACK.—H. L. Riouff, Pleasant Ridge, Ohio.
117,115.—FLY WHEEL.—C. Root, Cleveland, Ohio.
117,116.—CUTTING TIRES, ETC.—H. B. Seavey, Vienna, Me.
117,117.—LADDER.—E. O. Shepardson, St. Louis, Mo.
117,118.—HORSE COVER.—S. Sibley, Chelsea, Mass.
117,119.—MOLD.—I. Smith, New York city.
117,120.—CARD HOLDER.—E. Stewart, Fort Madison, Iowa.
117,121.—FRUIT JAR.—L. C. Straub, Pittsburgh, Pa.
117,122.—PULP MACHINE.—J. Taylor, Luzerne, N. Y.
117,123.—EVENER.—M. Terrill, Star Prairie, Wis.
117,124.—REFRIGERATOR.—M. A. Thornton, Perrysburgh, O.
117,125.—FLAX PULLER.—S. W. Tyler, Troy, N. Y.
117,126.—WASHING MACHINE.—M. Van Auken, Utica, N. Y.
117,127.—STEAM HEATER.—D. Vaughan, Cincinnati, Ohio.
117,128.—SPIKE MACH. O. A. Wadsworth, Allegheny City, Pa.
117,129.—CHIMNEY COWL.—J. Walker, Boston, Mass.
117,130.—GRIDDLE GREASER.—L. Vard, Poughkeepsie, N. Y.
117,131.—CHANDELIER.—R. F. White, Hoboken, N. J.
117,132.—CHAIR.—G. C. Winchester, Ashburnham, Mass.
117,133.—PICTURE FRAME.—R. Wright, Brooklyn, N. Y.
117,134.—PAPER STOCK.—W. Adamson, Philadelphia, Pa.
117,135.—EXTRACTING RESIN.—W. Adamson, Phila., Pa.
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117,235.—DITCHING MACHINE.—B. Rhett, Abbeyville, S. C.
117,236.—JAR CAP.—W. Taylor, C. Hodgetts, Brooklyn, N. Y.

REISSUES.

4,470.—TRIP HAMMER.—J. C. Butterfield and J. Hay, Chicago, Ill.—Patent No. 109,326, dated October 18, 1870.
4,471.—Division A.—GUN CARRIAGE.—J. B. Eads, St. Louis, Mo.—Patent No. 93,691, dated August 17, 1869.
4,472.—Division B.—GUN CARRIAGE.—J. B. Eads, St. Louis, Mo., Patent No. 93,691, dated August 17, 1869.
4,473.—WRINGER ROLLER, ETC.—J. F. Holt, Providence, R. I.—Patent No. 49,030, dated July 25, 1865; reissue No. 3,930, dated April 19, 1870.
4,474.—CULTIVATOR.—L. Packard, Galesburg, Ill.—Patent No. 25,037, dated August 9, 1857.
4,475.—HYDRANT.—W. Race, Lockport, N. Y., and S. R. C. Matthews, Philadelphia, Pa.—Patent No. 19,306, dated January 26, 1858.
4,476.—CARBURETER.—B. Sloper, St. Louis, Mo.—Patent No. 115,998, dated June 13, 1871.
4,477.—SILVERING GLASS.—W. A. Walker, New York city.—Patent No. 97,838, dated Dec. 14, 1869.
4,478.—STEAM PUMP.—N. W. Wheeler, Morristown, N. J.—Patent No. 115,670, dated June 6, 1871.

DESIGNS.

5,127.—GROUP OF STATUES.—H. C. Brix, Copenhagen, Denmark.
5,128.—SHOW CASE.—W. H. Core, New York city.
5,129.—CLOCK FRONT.—W. H. Griffiths, Boston, Mass.
5,130.—JELLY GLASS.—T. R. Hartell, Philadelphia, Pa.
5,131.—TABLE CASTER.—C. H. Latham, Lowell, Mass.
5,132.—CAKE PAN.—A. Reid, Buffalo, N. Y.

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EXTENSIONS.

HARVESTER.—J. P. Manny, of Rockford, Ill.—Letters Patent No. 17,798, dated July 14, 1857; reissue No. 3,580, dated August 3, 1869.—Division A.
HARVESTER.—J. P. Manny, of Rockford, Ill.—Letters Patent No. 17,798, dated July 14, 1857; reissue No. 3,581, dated August 3, 1869.—Division B.
HARVESTER.—J. P. Manny, of Rockford, Ill.—Letters Patent No. 17,779, dated July 14, 1857; reissue No. 3,524, dated June 29, 1869.—Division A.
HARVESTER.—J. P. Manny, of Rockford, Ill.—Letters Patent No. 17,779, dated July 14, 1857; reissue No. 3,525, dated June 29, 1869.—Division B.
HARVESTER.—J. P. Manny, of Rockford, Ill.—Letters Patent No. 17,779, dated July 14, 1857; reissue No. 3,526, dated June 29, 1869.—Division C.
LOCK.—L. F. Munger, of Rochester, N. Y.—Letters Patent No. 17,806, dated July 14, 1857; reissue No. 62, dated April 2, 1861.
COTTON GIN.—D. Pratt, of Prattville, Alabama.—Letters Patent No. 17,806, dated July 14, 1857.
CENTERING MACHINE.—E. F. Whiton, of Stafford Springs, Conn.—Letters Patent No. 17,814, dated July 14, 1857.
STEAM TIGHT JOINT.—M. J. Kelsey, of Brooklyn, N. Y.—Letters Patent No. 17,855, dated July 21, 1857.
PASSENGER FARE BOX.—J. B. Slawson, of New York city.—Letters Patent No. 17,899, dated July 28, 1857; reissue No. 550, dated May 4, 1858; reissue No. 4,240, dated January 24, 1871.

APPLICATIONS FOR EXTENSION OF PATENTS.

MANUFACTURE OF SEAMLESS FELT GARMENTS.—Delos W. Gitchell, Newburgh, N. Y., and Luther W. Badger, Elizabeth, N. J., have petitioned for an extension of the above patent. Day of hearing, October 4, 1871.

COTTON SEED PLANTER.—T. W. White, Milledgeville, Ga., has petitioned for an extension of the above patent. Day of hearing, October 4, 1871.

HARVESTER.—Hosea Willard and Robert Ross, Vergennes, Vt., have petitioned for an extension of the above patent. Day of hearing, October 18, 1871.

MELODEON.—Stanley A. Jewett, Cleveland, Ohio, has petitioned for an extension of the above patent. Day of hearing, September 27, 1871.

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June 27 to July 3, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.

BATTERY GUN.—J. P. Taylor, Elizabethton, Tenn.
CARTRIDGE CASE.—G. H. Berdan (of New York), St. Petersburgh, Russia.
DOUBLE CRANK.—E. Quinn, Brooklyn, N. Y.
LUBRICATING COMPOUND.—W. Salamon, New York city.
MIXER.—J. Dixon, New York city.
PAPER FILE.—A. A. Schlesinger, New York city.
POSTAL ENVELOPE.—E. J. Smith, Washington, D. C.
REAPER AND MOWER.—C. H. McCormick, Chicago, Ill.
RIPPING INSTRUMENT, ECT.—J. O. Woods, New York city
WATER METER.—C. W. Kinne, Cortland, N. Y.

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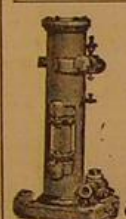

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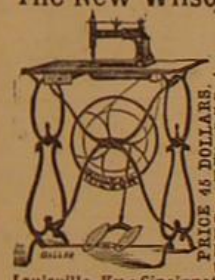

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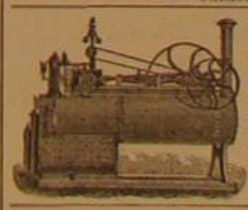

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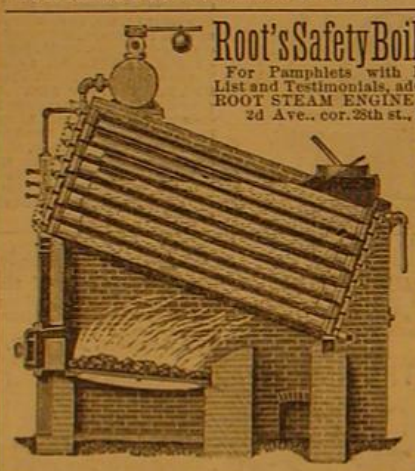

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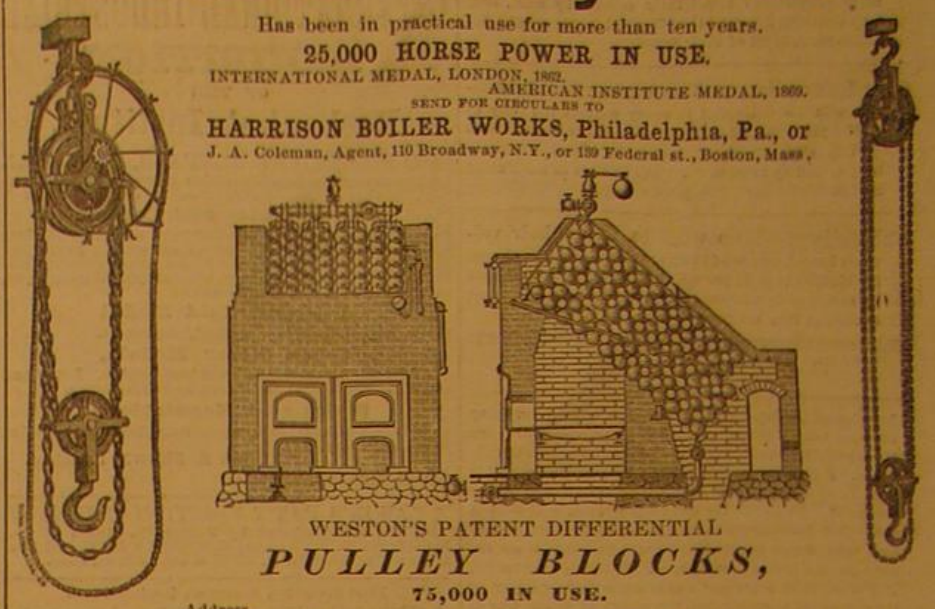

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STREET ARCHITECTURE IN LONDON.

The tasteful building we herewith illustrate has two fronts, one in Throgmorton street, the other in Austin Friars, London. The style adopted is Venetian Gothic, somewhat modified in treatment to suit the position. The structure consists of basement, ground, first, second, third, and fourth or attic floors. It is an admirable specimen of business architecture. The basement consists of offices and two double sets of inner and outer fireproof strong rooms, one of the principal inner ones for bullion being lined throughout with steel plates, and the whole being fitted with Chubb's bank fireproof doors.

The ground floor is planned so as to utilize the light right through, with the addition of a large well hole in the center for light and air, the base of it being covered with external and internal iron skylights; the latter is a wrought iron horizontal light of Gothic design, glazed with embossed glass, adequate provision being made for portions of the light to open with concealed machinery. The whole of the glazed screens and lobbies are executed in wainscot, French polished, of Gothic character, and glazed with embossed plate glass of diaper pattern.

There are two staircases leading to the first floor; one for the use of a distinct suite of offices on the first floor, the other in the rear being for general use. The first staircase referred to is of oak, with oak handrails and balusters, carved and molded in Gothic character. The staircase in the rear is of Spinkwell Yorkshire stone, fitted with an iron balustrade.

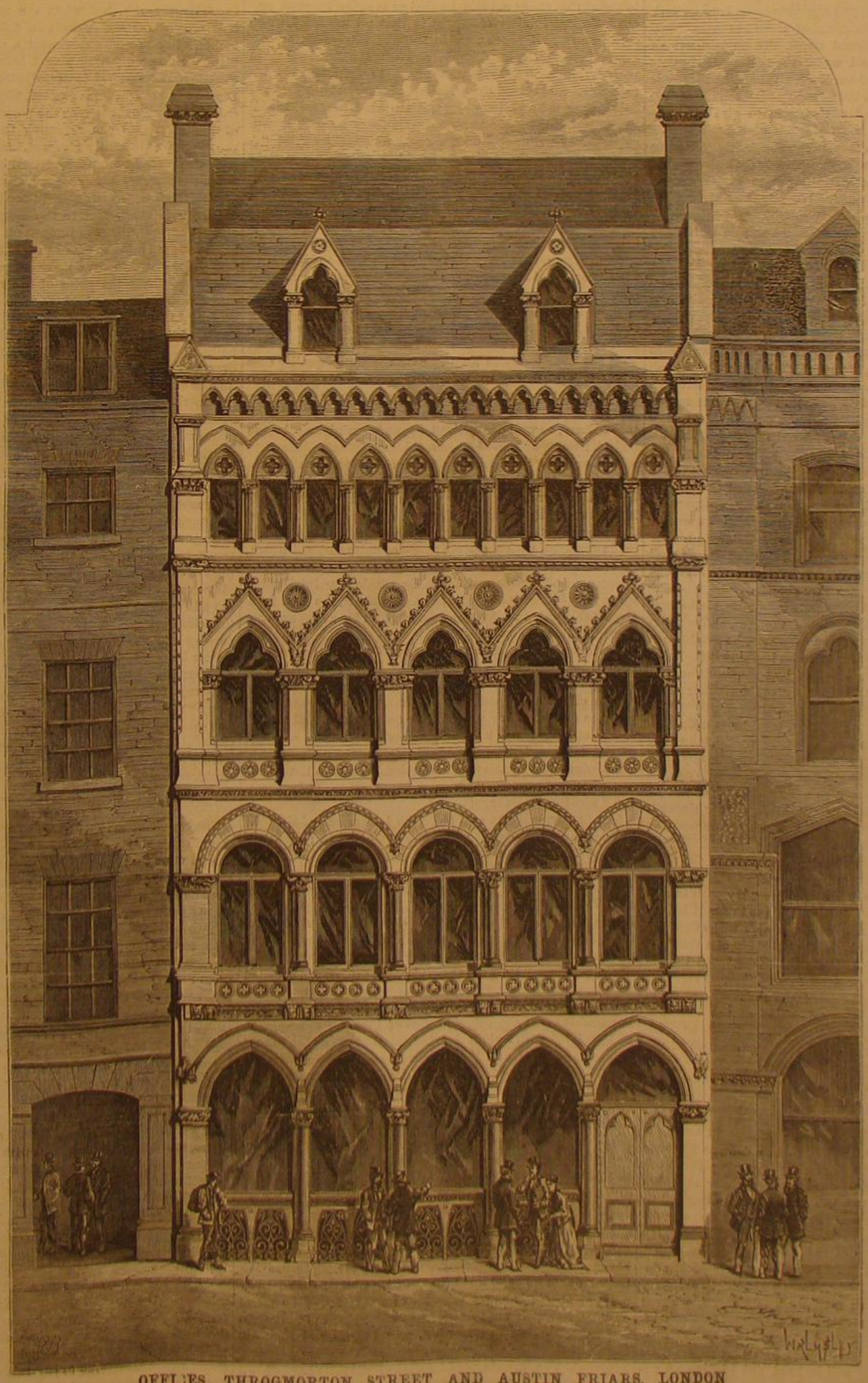
The whole of the first floor is separated from the ground floor by wrought iron girders on iron columns and stanchions, and cast iron subgirders, with arches in three and four rings respectively, of Cubitt's tiles, the spandrels being filled in with concrete, with flooring over it, to form an excellent fireproof floor.

The joinery is executed partly in wainscot and partly in deal, slightly stained and varnished. There are marble, Painswick, and inlaid chimney pieces, and stoves to match in character.

The well holes are lined with Minton's tiles, and the entrance lobby is laid with a tile paving. The ground floor has flat iron lath revolving shutters.

The exterior in Throgmorton street is faced throughout with brown Portland stone; the rear front, to the hight of the ground floor, with the same; above which level are white brickwork and stone dressings. The Throgmorton street front is supplied with polished Peterhead granite columns of red and gray on the ground and first floors respectively, and on the second and third floors with polished red and green serpentine columns. For ventilation of the offices and rooms, there is a system of flues with gas jets at their mouths to give an upward current for carrying off the foul air, the fresh air being admitted through brass hit-or-miss gratings placed between the window sills and floors; the fan-lights, too, are hung to transmit a current of fresh air through the offices.

The architect is Mr. Thomas Chatfield Clarke.



OFFICES, THROGMORTON STREET AND AUSTIN FRIARS, LONDON

How Enameled Cloth Is Made.

Enameled cloth enters into many uses as a substitute for leather. It is light and pliable, and, at the same time, firm and durable. It has all the appearance of leather, with nearly all its durability. Its most important use is that of covering for carriage tops, for traveling bags, and trunks. It is extensively employed in the manufacture of cushions and upholstering of a similar nature, and not rarely is it worked up into rainproof coats and pants. We briefly describe the process of manufacturing the black enameled cloth, which enters mostly into consumption. The foundation of the article is cotton cloth of the best quality, made expressly for this manufacture. It varies in texture and width according to the kind of goods for which it is intended. The cloth is taken from the bale and wound upon a large cylinder, and looks in that position very much like the huge rolls of home-made cloth, seen in the garrets and chambers of many old New England farm houses, when weaving was in fashion. It is now ready to receive its first coat; so it is slowly passed through the machine, across and between the huge iron cylinders, from the smaller of which, at the top, it receives its first coating of composition—a black disagreeable looking substance, composed of oil, lampblack, resin, and other ingredients, boiled together till about the consistency of melted tar. From between the cylinders, dressed in its black coat, the cloth is carried to and wound upon a huge wooden frame, resembling in shape the old-fashioned reel. By an arrangement of spokes upon the arms of this huge wheel, each layer of cloth is kept separate, so that no two portions of the cloth will come in contact. The frame, with its contents when filled, is passed into what is called the heater, an apartment kept at a high temperature, for the purpose of drying in the coating or composition. After remaining in the heater a sufficient length of time to complete the drying

process, it is removed and passed through the hands of workmen who make all the rough places smooth. It is laid on long tables, and the workmen alternately sprinkle with water and rub with pumice stone, till the whole surface is made perfectly smooth. The cloth is then wound upon the cylinder again, as at first, and passed through the machine to the huge reels, and again under the pumice stone. The cloth is passed through the machine five times, or till the required thickness has been laid on. After the last scrubbing down, the fabric is taken to another department, thoroughly varnished, and again passed through the heater. It is now represented as a piece of cotton cloth, with a thick, shining coat of black, very much resembling patent leather. But it has not yet received its leather finish; so in another apartment it is passed through the enamel machine, which consists of another set of huge rollers, one of which covers its surface with regular indentations, resembling the grain of leather. The cloth is now carefully measured, and rolled up in packages of suitable size, put up in boxes, and is ready for the market.

TYNDALL'S FRAGMENTS OF SCIENCE FOR UNSCIENTIFIC PEOPLE."

The fragments are not all of them easy reading. You cannot run through them as you can through a lady writer's romance, although certain portions of them are more sensational than the most sensational novel. There is never an attempt to hide rough ground under the flowers of rhetoric or the sticks and straws of verbiage. Wherever there are hard places to be traversed, Professor Tyndall tells you they are and will be hard, and advises you to gird up your loins accordingly. When the trying bit of climbing is accomplished, he says, like a man, "Thus patiently you have accompanied me over a piece of exceedingly difficult ground; and I think as a prudent guide, we ought to halt upon the eminence we have now attained. We might go higher, but the boulders begin here to be very rough. At a future day we shall, I doubt not, be able to overcome this difficulty, and to reach together a greater elevation."

Such frankness, combined with such lucidity, renders the reading of Professor Tyndall's works a mental tonic. They often require the effort which it takes to plunge bodily into a chilly pool, but the resulting re-action of conscious energy and delight more than compensates for the effort. The Professor's mind is doubly clear; clear to itself and clear to others. Obscured by no mists, it puts forth no humbug. It has never been the writer's privilege to hear this gifted lecturer's *ciel coce* discourse, but certain he is that he would never do what he relates what Faraday did upon occasion. Faraday did not confine himself to experimental discovery. He aspired to be a teacher, and reflected and wrote upon the method of scientific exposition. "A lecturer," he observes, "should appear easy and collected, undaunted and unconcerned;" still, "his whole behavior should evince respect for his audience." These recommendations were afterwards in great part embodied by himself. Dr. Tyndall doubts his unconcern, but his fearlessness was often manifested. It used to rise within him as a wave, which carried both him and his audience along with it. On rare occasions also, when he felt himself and his subject hopelessly unintelligible, he suddenly evoked a certain recklessness of thought, and without halting to extricate his bewildered followers, he would dash alone through the jungle into which he had unwittingly led them; thus saving them from *ennui* by the exhibition of a vigor which, for the time being, they could neither share nor comprehend.

Now Professor Tyndall, we believe, would never do anything of the kind. In the first place, he would take good care never to lead his hearers into a jungle unwittingly; and in the second place, if he had strayed with them into one, he would make it a point of honor to pilot them out of it. So long as an uncouth difficulty is malleable, he never tires till he has hammered it into shape; if it be utterly refractory, he tells you it is so, and lets it alone.

"Let us get a clear idea of this," or words to the same purport, is his constant and urgent appeal to his hearers when about to attack some knotty point. "My wish to render our mental images complete, causes me to dwell briefly upon these known points, and the same wish will cause me to linger a little longer among others." "My aim throughout has been to raise in your minds distinct physical images of the various processes involved in our researches." He struggles heroically to be clear, and the endeavor results in his being clear. Witness his explanation of the chemical action of certain rays of light, and the way in which he obstinately persists in not allowing the leading principle of the undulatory theory of light to be forgotten.

"Here I would ask you to make familiar to your minds the idea that no chemical action can be produced by a ray that does not involve the destruction of the ray. But the term "ray" is unsatisfactory to us at present, when our desire is to abolish all vagueness, and to fix a definite physical significance to each of our terms. Abandoning the term 'ray' as loose and indefinite, we have to fix our thoughts upon the waves of light, and to render clear to our minds that those waves which produce chemical action do so by delivering up their own motion to the molecules which they decompose."

Or let us take polarized light as an example. Most educated persons have heard of polarized light; they certainly see it every day, as their attendants talk prose, without knowing it. They may perhaps have seen its brilliant effects displayed in the microscope of some ingenious neighbor. But ask them in what respect polarized differs from unpolarized light, and they will be hard put to give an answer. The present writer has seen no answer to the question to be compared, in respect to clearness and capability of popular comprehension, with Professor Tyndall's explanation. "There is another subject connected with our firmament, of a more subtle and recondite character than even its color. I mean what Herschel calls that 'mysterious and beautiful phenomenon,' the polarization of the light of the sky. The polarity of a magnet consists in its two endedness, both ends, or poles, acting in opposite ways. Polar forces, as most of you know, are those in which the duality of attraction and repulsion is manifested. And a kind of two-sidedness, noticed by Huygens, commented on by Newton, and discovered by a French philosopher named Malus, in a beam of light which had been reflected from one of the windows of the Luxembourg palace in Paris, receives the name of polarization." In short, a beam of polarized light has two sides, which differ from each other in their nature, qualities, and effects. If the beam be flat and broad, like the blade of a knife, one side is sharp and thin, as it were, the other flat and blunt; if the beam were cylindrical, like a walking stick, or square like a draper's measure, one half of it might consist of wood, the other of barley sugar. The opposite sides of a polarized beam of light differ quite as much as that.

This clearness is a natural consequence of Professor Tyndall's writings being eminently truthful. It may be too much to assert that every muddle headed or muddle tongued person is untruthful, but certain it is that all uncandid, insincere persons, all rogues, swindlers, and intriguers, are obscure, involved, contradictory, and often unintelligible in their sayings. "Speech was given to man to hide his thoughts," said one of the artfullest of men. Professor Tyndall is too good a philosopher, and too kind hearted, to hit any fellow philosopher hardly; but is there no well known cotemporary writer open to some such a remark as this? "A favorite theory—the desire to establish or avoid a certain result—can so warp the mind as to destroy its power of estimating facts. I have known men to work for years under a fascination of this kind, unable to extricate themselves from its fatal influence. They had certain data, but not, as it happened, enough. They supplemented the data, and went wrong. From that hour their intellects were so blinded to the perception of adverse phenomena, that they never reached truth."

What Professor Tyndall knows, he does know, and says that he knows it, and why. What he does not know he has the courage to state that he does not—adding, perhaps, that he is not ever likely to know. "Of the inner quality that enables matter to attract matter, we know nothing." While he feels a natural pride in scientific achievement—while he regards science as the most powerful instrument of intellectual culture, as well as the most powerful ministrant to the material wants of men—if you ask him whether science has solved, or is likely in our day to solve, the problem of this universe, he is obliged to shake his head in doubt. As far as he can see, there is no quality in the human intellect which is fit to be applied to the solution of the problem. It is entirely beyond us. He compares the mind of man to a musical instrument, with a certain range of notes, beyond which, in both directions, we have an infinitude of silence. The phenomena of matter and force lie within our intellectual range; but behind, and above, and around all, the real mystery of this universe lies unsolved, and, as far as we are concerned, is incapable of solution.

Professor Tyndall once walked down Regent street with a man of great gifts and acquirements, discussing with him various theological questions. He could not accept his views of the origin and destiny of the universe, nor was he prepared to enunciate any views of his own. His friend turned to him at length and said, "You surely must have a theory of the universe." That he should in one way or another have solved this mystery of mysteries, seemed to the speaker a matter of course. "I have not even a theory of magnetism," was the modest reply.

The human brain is said to be the instrument of thought and feeling; when we are hurt, the brain feels it; when we ponder, it is the brain that thinks; when our passions or affections are excited, it is through the instrumentality of the brain. But at this point Professor Tyndall very properly asks for a little more precision. How does consciousness infuse itself into the problem? Granted that a definite thought, and a definite molecular action in the brain, occur simultaneously, we should be as far as ever from the solution of the problem, "How are these physical processes connected with the facts of consciousness?" The chasm between the two classes of phenomena would still remain intellectually impassable. Let the consciousness of love, for example, be be associated with a right handed spiral motion of the molecules of the brain, and the consciousness of hate with a left handed spiral motion. We should then know, when we love, that their motion is in one direction, and when we hate, that their motion is in the other direction; but the "why?" would remain as unanswerable as before.

We travel with confidence under such a guide, and do not hesitate to inspect with him the objects that happen to lie in our path.

Telegraphs in China.

At the last meeting of the "Danish Great Northern China and Japan Extension Telegraph Company," held at Copenhagen, a report on telegraphy was read by Mr. Tietgen, director. He said that the line between China and Japan is now open, and there is every reason to expect it will be much used. The number of telegrams sent last year to China from Denmark, Sweden and Norway, was 140,000, and they are transmitted with far greater rapidity than was at first expected. The Russian and Chinese governments have shown themselves very favorable to the undertaking; the former has given great facilities for extending the line to Vladivostock, which is to be the new Russian naval station on the Pacific, its harbor being closed only during two months in the year. M. Sick, who was sent by the Danish government to Japan on a political mission, put the Company's agent in communication with the Japanese authorities, the result being that a telegraph cable has been brought to Nagasaki, and a telegraphic line will be established between the Japanese ports which are open to Europeans. The telegraphists who have been sent to China have, says M. Tietgen, acquired such a mastery over the Chinese language that they now accept and send telegrams in Chinese from place to place in the empire.

Lord Lindsay's Magnetic Experiments.

At the recent *conversazione* of the Institute in Great George street, Lord Lindsay exhibited a very powerful magnet, and during the evening himself conducted some experiments with it and some vacuum tubes, as mentioned in our report of the *soirée*. These experiments, which were both magnetic and diamagnetic, were very interesting. The poles of the magnet were 2½ inches square in section, and the magnet was excited by a 30 cell Grove battery. The poles were kept $\frac{3}{16}$ of an inch apart, and a half crown piece was placed between them. When the magnet was not excited the coin dropped instantly through, but when the magnet was charged, the half crown was six seconds in falling the distance of 2½ inches. In a second experiment a small india rubber tube filled with mercury was placed between the poles, and an electric current passed from the battery through the mercury. Directly the magnet was excited, the tube was set in motion, getting away from between the poles and assuming the shape of the letter S. Upon reversing the current the shape of the curve was instantly reversed. After this, a coil of copper wire was placed round the vertical pole of the magnet, and when the magnet was charged, and a current of electricity sent through the copper coils in one direction, the ring of fine copper wire stuck fast to the magnet. On reversing the electric current, the ring jumped off the pole of the magnet some distance into the air. In order to show the diamagnetic properties of warm air, a lighted taper was passed through a hole bored along the poles of the magnet, the light being brought to the space of ¼ inch wide between the two poles. So long as the magnet was excited, the light burned brilliantly, the smoke coming out at the extreme ends of the poles, and not rising up directly off the flame. As soon, however, as the magnet was discharged, the smoke rose straight up and extinguished the flame.

Experiments were next made with some vacuum tubes exhibited by Mr. Cromwell Varley, to show that the luminous arch was dependent wholly upon the magnetism, and was independent of the direction of the electric current. The discovery of this arch is due to Plucker, and it has been examined by Mr. Varley and found to consist of very attenuated matter, thrown off from the negative pole. This was demonstrated in the following manner:—A strip of talc, $\frac{1}{10}$ of an inch broad and one inch long, weighing $\frac{1}{10}$ of a grain, was suspended in the exhausted tube by means of a single fibre of raw silk. When the luminous arch was allowed to play against this piece of talc, it repelled it, and although the silk did not burn, yet the glass tube was made hot. From this circumstance Mr. Varley infers that the electric current passing into the negative pole detaches small particles of matter from it. These particles are thrown off with tremendous rapidity, and are controlled in their course by the magnetic rays forming the luminous arch, the heat in the glass being produced by the concussion of these particles against the solid body. Lord Lindsay, who is largely engaged in physical experiments, is having a monster magnet constructed, which, when completed, will, it is said, be the largest in the world.—*Mechanics' Magazine.*

The Unscientific Window.

The casement may be defined "the unscientific window." Here in this single structure you may see most of the intel lectual vices that mark the unscientific mind. The scientific way is always the simple way; so here you have complication on complication; one half of the window is to go up, the other half is to come down. The maker of it goes out of his way to struggle with Nature's laws; he grapples insanely with gravitation, and therefore he must use cords, and weights and pulleys, and build boxes to hide them in—he is a great hider. His wooden frames move up and down wooden grooves open to atmospheric influence. What is the consequence? The atmosphere becomes humid; the wooden frame sticks in the wooden box, and the unscientific window is jammed. What ho! Send for the curse of families, the British workman! Or one of the cords breaks (they are always breaking)—send for the curse of families to patch the blunder of the unscientific builder.

Now turn to the scientific window; it is simply a glass door with a wooden frame; it is not at the mercy of the atmosphere, it enters into no contest with gravitation; it is the one rational window upon earth. If a small window, it is a single glass door, if a large window, it is two glass doors, each calmly turning on three hinges, and not fighting against God Almighty and His laws when there is no need.

The scientific window can be cleaned by the householder's servants without difficulty or danger; not so the unscientific window.

How many a poor girl has owed broken bones to the casement mania! Now-a-days humane masters afflicted with unscientific windows send for the curse of families whenever their casements are dirty; but this costs seven or eight pounds a year, and the householder is crushed under taxes enough without having to pay this odd seven pounds per annum for the nescience of the builder.—*Charles Reade.*

EXPERIENCES OF A BUREAU OFFICER.

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

I was struck at once with the great preponderance of females among the applicants for office. There are in the Patent Office, in round numbers, about 250 male employés and about 65 females. A proper proportion would have made the number of applicants about four males to one female. In fact, the proportions were more than reversed, so that, having in view the number of offices to be filled, the women who applied were to the men in the proportion of about twenty to one. They were also by far the most persistent applicants. It was next to impossible to keep them out of one's room, and next to impossible to get them out when they once came in. A refusal was apt to be followed by a flow of tears, and a soft hearted Commissioner was likely to be severely tried. Unfortunately the speaker acquired the reputation of being soft hearted. Inexperienced in public life, and accustomed to treat ladies with some degree of deference, he was slow to acquire the necessary gruffness to frighten these visitors away. In truth there were many sad tales of poverty, suffering, and toil which even a hard hearted man could not have heard without emotion. A man once flung himself on his knees and begged for a place to keep his family from starving; and a well dressed lady, leading her little children into my presence, proposed to do similar obeisance with the whole family if I had not promptly declared that such a demonstration would close the door of appointment forever. I learned to distrust some tears, but there were others the genuineness of which I could not doubt; and when they shed tears of joy at receiving their places, I was soft hearted, and perhaps soft headed, enough to suppose that they really needed them. A widow, mother of an invalid child, had presented her petitions and recommendations. She was a woman of worth, intelligence, and education, and it seemed proper that her prayer should be granted. The sickness of her child kept her at home for some days, when she called to learn her fate. In official phraseology I said: "I am happy to inform you that we have given a favorable consideration to your case." She received this remark rather coolly, until after a few moments' further conversation I asked her if she could report for duty on the following Monday. "Why," she exclaimed, "am I appointed?" "That is what I meant to say a moment ago." One joyful glance, and then bursting into tears she exclaimed: "Oh, Mr. Fisher, you don't know how much good you have done!"

The greater number of applicants of the other sex came from Virginia and the District of Columbia. In fact out of 300 employés in the Patent Office, 100 were from the District. A lady resident in Washington could always command more Congressional friends than one from a distance. The poor soldier's widow or daughter in the country had but one representative. The young miss of the capital brought in her train a couple of Senators, four or five members of the Lower House, a general or two, and perhaps a gruff admiral or commodore. If she were removed she would assault you with such an array of influence that you seriously began to ask yourself the question whether your retention in office or hers was of the greater importance to the nation. The number of these applicants, and the determination with which they pressed their claims, has led many persons to doubt the expediency of the employment of females in the government offices. I do not share in this feeling. It must be remembered, in justification of the number of applications, that the number of occupations which an educated woman can enter is very limited; that the salaries paid in the departments are above the average wages which a woman can obtain in any other office; while every department of life is open to young men, with the reasonable hope of soon obtaining better compensation than any government office can afford to pay. I caused careful tables to be prepared, showing the attendance and work of the females employed in the Patent Office. The result shows that the attendance is as good as that of the men, and the work is rather better. Some of the lady clerks had no equals among the gentlemen, and, tested by the regularity, quantity, and quality of their work, they and many of the men should have changed salaries. Nevertheless, until a year ago the highest wages a woman could get was $900 per annum, while the lowest paid to a young man, except in a few exceptional cases, was $1,200 per annum. Now the heads of departments are authorized to appoint clerks of both sexes at the same salaries. The first appointments under this law, I am happy to say, were made in the Patent Office. Before the passage of this law a lady received $700 for doing the work previously performed by a gentleman whose compensation was $1,800. Another lady, the widow of a physician formerly well known in this city, and who gave his life for his country in a gangrene hospital, performed for $900 the duty of superintending a division of twelve clerks, for which her male predecessor was paid $1,600, and she proved much the better of the two. Another, for 1,200 had charge of a division which, in the Treasury Department, would have entitled its chief, if a man, to a salary of $2,000, and he would have felt hardly used at that. Still the work was done cheerfully and well, with a laudable ambition to succeed and reflect credit on the department. It is true that nearly every man in and out of the office who could detect the slightest error in their work thought himself fully justified in sneering at the work of women, but, as these errors were less than one-half of those which had been experienced when the work was done by young men, the good sense of the general public at length triumphed over this prejudice, at once so absurd and unkind. The ladies' department of the office is in the basement, on Ninth street, entirely removed from the rooms of other clerks. No gentleman occupies any portion of their rooms or halls, and male clerks or visitors are not allowed to appear upon that floor of the building unless upon business. The rooms are light and pleasant, owing much of their cheerful appearance to the taste of the ladies themselves.

A good deal has been said concerning the various influences or kinds of pressure that are applied to government officers to control their action. It is the fact that, even as to matters in which the action of such officers is purely judicial, there is a tendency to approach them with *ex parte* statements and requests for favorable action, that would be thought very strange outside of Washington. If a member of Congress should approach one of your judges here in Cincinnati, and tell him that one of the parties to a suit before him was his constituent to whom he was under great obligations, and that he would therefore take it as a great personal favor if he would decide the case in favor of his friend, the judge would probably open his eyes a little. But this seems to be the rule rather than the exception at the capital. It is one of the legitimate fruits of the present system of appointment. It is so much a matter of course to bring every influence to bear, upon the mind of an official on behalf of an applicant, that it is easy to forget that the same influences may be exceedingly improper when directed to the discharge of the ordinary duties of his office.

After I had delivered the address at the decoration of the soldiers' graves at Arlington, I was fairly deluged for two or three weeks with letters filled with the most extravagant praise of that production, and invariably winding up with a request for office. Having retained my interest in Sabbath schools and the Young Men's Christian Association, it was no uncommon thing to receive, the next day after some address on behalf of those agencies, a letter taking strong grounds in sympathy with such remarks as I had made, and winding up with the inevitable request for office. One lady said she had been much impressed by my remarks upon the subject of consecrating our means to Christ. She wished to adopt them as her own rule of action. Unfortunately, however, she had no means to consecrate. Would I appoint her to a clerkship in the Patent Office, "so that she might be able in the future to do something in so good a cause?" Another, who was an applicant for a patent which had been rejected, wrote that she wished that I would grant her application. She knew it would be wrong to offer any compensation to a public officer, but that which I would not do for money would I not do for Christ's sake, whose follower she was? More unkind than this was another communication from a would be contractor whose bid happened to be the lowest, but who wrote to persuade me that it was nevertheless much the best, and wound up his letter by wishing me "health and prosperity, as well as the kind and watchful care of our common Father and the daily companionship of His Son, our blessed Lord and Saviour." I trust that I shall never undervalue or reject the Christian sympathy of any one, and certainly I cannot afford to despise or reject any good wishes for my welfare; but one does come at last to suspect a little the value of such wishes as these, where the earthly and the heavenly, the temporal and the spiritual, are so curiously mingled together.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of June, 1871:

During the month, there were 603 visits of inspection made, and 1,332 boilers examined—1,319 externally and 371 internally, while there were 165 tested by hydraulic pressure. Number of defects in all discovered were 533. Dangerous defects, 114. These defects were, in detail, as follows:

Furnaces out of shape, 23—3 dangerous; fractures in all, 68—28 dangerous; burned plates, 54—26 dangerous; blistered sheets, 34—2 dangerous; cases of sediment and deposit, 72—6 dangerous; incrustation and scale, 97—10 dangerous; external corrosion, 37—4 dangerous; internal corrosion, 29—6 dangerous; internal grooving, 6—1 dangerous; water gages out of order, 22—1 dangerous; blow-out apparatus in bad condition, 7; safety valves overloaded or corroded fast in their seats, 17—4 dangerous; pressure gages out of order, 85—6 dangerous, varying from —40 to +60; cases of deficiency of water, 2—both dangerous; broken braces and stays, 30—5 dangerous; boilers condemned, 8.

Among the defects enumerated above, is one where a stop valve was placed between the safety valve and boiler. These irregularities are not as frequently met with as they formerly were. There have been a number of very destructive explosions resulting from over pressure, with escape and release by the safety valve entirely cut off, and steam users of late have been careful to avoid this defect. A boiler under steam, with no openings for the release of over pressure, is little less dangerous than a powder magazine with an ignited slow match connecting with it. The carelessness of some men is truly astonishing. If the danger incurred affected only themselves there would be less occasion for concern. But, unfortunately, the well being of many others is usually involved. It not unfrequently happens that safety valves are corroded in their seats, or so heavily weighted that no safe pressure would raise them. They are practically sealed, and quite as dangerous as the case of a stop valve between boiler and safety valve. If every steam user would go to the trouble and trifling expense of arranging cords and pulleys, so that the engineer could try the safety valve daily, without the trouble of going on to the top of the boiler, he would introduce a very judicious and important feature in the management of his steam power. Steam gages were found during the past month varying from —40 to +65. This state of things can only come about from an unreliable and worthless gage, or from entire neglect. The appliances of a boiler require attention. Wood and metal will wear and decay, and unless looked after and cared for, they may be as erratic in their work as a human being who has brought upon himself combined physical inabilities, from excesses and the neglect of sanitary laws. If, under good care, a steam gage is "wild" in its indications, throw it aside at once, and secure a good one. A gage indicating —40 is a very dangerous boiler attachment; for, if the engineer were running by it, as he supposed, with 80 lbs. pressure, he would be actually running at a pressure of 120 lbs. Hence, as stated above, boiler attachments are not expected to run always and forever without care or attention. A good rule is, get the best and take good care of it.

Chloroform.

Chloroform, the most important of all anæsthetics, was discovered first by M. Soubeiran, in 1831; then by Baron Justus Von Liebig; and its chemical and physiological properties were more fully investigated by Dumas in 1835. It is formed from chlorine acting on marsh gas, and is prepared on the large scale by distilling together bleaching powder (chloride of lime) containing a little quicklime to render it alkaline, water, and spirits of wine, or wood spirit; the distilled liquor is then shaken with several successive portions of distilled water to free it from any soluble impurities, agitated with its own weight of pure oil of vitriol, and lastly, distilled from a mixture of chloride of calcium and quicklime, which removes every trace of water and acid, and renders it much more permanent and safe to use than if these impurities were allowed to remain. The specific gravity of pure chloroform is variously given at 1·497, 1·500 and 1·525; the last density, however, is too high, as the chloroform of the best makers is generally 1·497 or 1·500. It is a dense mobile liquid, having a pleasant ethereal odour and a warm, sweet taste; exposed to the air it rapidly volatilizes, leaving no residue; it boils at 141° F., and is not easily made to catch fire, but when it burns, it does so with a dull, smoky, greenish flame. Chloroform vapor is rapidly absorbed by the atmosphere, and this capacity of absorption varies with the temperature, having a certain definite maximum for each degree; for instance, it is found that air at 40° F. will take up 6 per cent of vapor, while air at 90° F. is capable of taking up 35 per cent.

Chloroform is also the best known solvent for camphor, resins, sealing wax, and gutta percha; it also dissolves the vegetable alkaloids, strychnia, morphia, quinia, etc., in large proportions, and is very useful as a local anæsthetic in allaying the pain of toothache; as a solvent it will remove greasy spots from fabrics of all kinds, but its chief use is as an anæsthetic, of which kind of medicinal agents it is the type. There are several other volatile organic bodies which possess similar properties, but none, so far as we have yet been able to discover, produce the total unconsciousness and muscular relaxation that follow the inhalation of chloroform.

Mammoth Factory for Canning Lobsters.

The factory referred to is that of Messrs. Wm. Underwood & Co., at Mount Desert, Me. There are employed during the busy season, about 150 men, women and children, and 50 fishermen, the wages of the latter averaging from $3.00 to $7.00 per day, while those employed in the factory earn from $9.00 to $11 per week. The boys and girls make bills ranging from $4.00 to $7.50.

The lobsters are brought in fresh every day, being caught within a radius of fifteen miles from the factory. Every lobster not coming up to the proper standard of excellence is rejected, and the greatest care is exercised in the cleaning and boiling. None but *live* ones are allowed to pass into the boilers.

The yearly product, at this factory, amounts to over seven hundred thousand cans. Besides the large amount required for the home market, they are shipped off in great quantities to England, France and Germany. These lobsters are put up in one, two and three pound packages.

There are in use, three large boilers, each having a capacity of 600 pounds, and three baths for boiling the cans after the lobsters are packed, for the purpose of exhausting the air, each with a capacity of 1,500 cans. The daily product now reaches from 4,000 to 5,000 cans. Few people are aware how small a portion of the lobster is used in the packing process. It takes 550 pounds of these shell fish to fill 100 one pound cans, nothing but the claws and tails being used. The bodies and refuse are made into a valuable fertilizer. The profits would be extremely small, were it not for the immense quantity put up, and the large demand.

Lobsters are running small and scarce this season, and it will probably be with considerable difficulty that dealers can fill orders.

Premiums awarded to Mowing Machines.

The mowing machines and hay tedders exhibited at the last Fair of the American Institute were tested by the following Committee of Judges on the farm of Samuel Sinclair at Croton on Wednesday, June 21: H. L. Reade, Jewett City, Conn; Josiah H. Macy, Rye, Westchester County, N. Y.; Frank D. Curtis, Charlton, Saratoga County, N. Y. The Board of Managers has since awarded the following premiums, in accordance with the report of the Judges:

No. 535.—Adriance, Platt & Co., No. 165 Greenwich street, N. Y. for the best mowing machine, "Buckeye." First premium.

No. 160—Sprague Mowing Machine Company, Providence, R. I., for the Sprague mower. Second premium.

No. 777— Clipper Mowing and Reaping Machine Company No. 154 Chambers street, N. Y., for the Clipper mowing machine. Certificate of honorable mention.

No. 7—Frank Bramer, for "Young Warrior" mower. Certificate of honorable mention.

No. 113—E. W. Bullard, for the Bullard hay-tedder. First premium.

[For the Scientific American.]

THE NEUROPTERS.

BY PROFESSOR E. C. H. DAY.

We have now touched upon six of the seven orders, into which the true insects are generally divided; examples having occurred to us of the dipters, the hymenopters, the lepidopters, the coleopters, the hemipters, and the orthopters. We have thus only left the Neuroptera, or nerve-winged insects. Any one who glances at the wing of the dragon fly, or devil's darning needle, as the children call it, will see at once the appropriateness of the term "nerve winged" to these typical forms of the group. The wings, of elegant outlines and of thin transparent substances, devoid of any scales, are strengthened by very numerous strongly defined nervures, arranged in peculiarly netted patterns of very great beauty; so that, while pleasing to the eye, they are also suggestive of great support to the delicate membrane. This perfect combination of large expanse, of lightness, and of strength in the wings, indicates a power of flight that entitles the dragon fly to be considered among the most aerial of all insects. The head is relatively large, the thorax small, and the abdomen generally very lengthened and slender; the legs are slight and weak; the compound eyes, supposed to be for "long sight," are disproportionately large, and the mouth is armed by powerful biting jaws, formed much on the pattern of those of the orthopters or grasshoppers. Such an insect is evidently meant for an active and aggressive existence; and no one who has watched these beautiful creatures, beautiful in their varied colors and metallic tints, as well as in their graceful outlines and rapid movements, darting over a still pool in search of insects on the wing, now seizing one with an action so swift as to baffle the eye, now alighting on a favorite perch to devour its prey and to watch for a fresh victim, can fail to compare them to the falcons amongst birds. This analogy is recognized in the popular name of "mosquito hawks," given to the common species. The French, in allusion to their elegance and beauty, and disregarding their habits, know them by the poetic appellation of "*demoiselles*."

In carnivorous habits, the larva of the dragon fly resembles the perfect insect; but fortunately for the inhabitants of the waters in which it dwells, it does not possess a similar rapidity of movement, while in appearance it is altogether hideous instead of charming. This horrid wingless creature, with its huge head and disproportionately long abdomen, and apparently inefficient limbs, is, however, a sufficiently terrible foe. In the face, it is armed with a strange weapon, its under lip is provided at the extremity with a pair of powerful nippers, that can be protruded considerably beyond the head; while at the opposite end of the body, we find a still more extraordinary mechanism for enabling it to reach its prey. It breathes chiefly through the vent, filling its intestine with water, which is then brought in contact with the branches of the trachea or air tubes. By a muscular movement, the creature can violently eject this water in a jet backwards, and in so doing is itself energetically driven forwards. This enables the wretch to spring upon its prey, which it seizes with its protruded nippers; and De Geer tells us that it will grasp and devour very small fish, and is not above the cannibalism of eating its own kind. It is strange how Nature, with her immense variety of mechanical contrivances, applies very different ones in creatures closely allied, while in other creatures, totally dissimilar, we meet again with the same principle. Thus, we find that the cuttle fish, at the head of the molluscan sub-kingdom, propels itself violently backwards by the forcible ejection of water from the muscular sac, within which its breathing organs lie.

Although the dissimilarity between the aquatic wingless larva and the mature dragon fly is so great, yet the metamorphosis of this creature is incomplete, as it continues active in the pupa state, then acquiring the rudiments of wings. In this it resembles the grasshoppers, passing, like them, from stage to stage, by merely moulting its outer skins.

Such is the typical Neuropter; now let us turn to the insect here figured, the *Phryganea*, better known as the stone fly of the English angler, with whom it is, both in its perfect and in its larval form, as the caddis or case worm, a favorite bait for the wary trout. At a glance you see how different this insect is from the dragon fly; the wings, wanting the delicacy and beautiful reticulations of the latter, are, moreover, clothed with minute hairs; the antennæ, very short in the mosquito hawks, in this are long; the feet are large and the legs are furnished with spines, and on examination, the mouth would prove to be formed of parts altogether rudimentary, when compared to the serviceable organs of the types of the order. You might, in fact, on a cursory examination, be excused for mistaking this creature for an ally of the clothes moth, so unlike is its superficial appearance to the neuropters. The resemblance does not even end here; the reader will recollect that the larva of the clothes moth makes itself a case of the substance on which it feeds; in which case it lives, protruding only so much of its body as is necessary for locomotion and feeding. So the larva of the stone fly, the caddis worm, living in the water, beneath stones and other shelter, makes itself a little tube, composed of fragments cemented together. The nature of the fragments will vary according to the species, each species confining itself, it is said, to one kind of material; some use grains of coarse sand, others particles of broken shells, or minute shells themselves, others, again, bits of wood or short lengths of rushes, or of the stems of grapes. Within such cases, the grubs live, feebly moving about, and seizing such small insect prey as comes unawares within their reach. When fully grown, they attach their case to some object, close it tightly, and pass into a pupa, or chrysalis stage. In this feature of their history, they thus again differ from the types of the neuropters; and so weighty have some of these points of difference seemed to some naturalist, that they have placed these phryganeids in an order by themselves, to which they have given the name of *trichoptera*, signifying "hairy wings." Most entomologists, however, retain them as true, though very aberrant, neuropters, reminding us strangely of the lower moths.

METAMORPHOSES OF THE STONE FLY.

In fact, this entire order, excepting the few typical families, is made up of very varied forms, often strangely imitative of other and distant groups. Thus, the white ants or termites, are neuropters, which, in social developments and even in appearance, greatly resemble the true ants among the hymenopters. The little damp-lice, that infest our books and cabinets, and are generally mistaken for true lice (which are hemipters), are, in reality, wingless members of this order. The delicate "lace wing" fly, the foe of the aphis and consequently, the friend of the gardener, and its next of kin, the myrmeleon, the parent of that cunning ant lion, of whose wonderful pitfalls every child has read, are more readily recognizable as belonging here, but even among these, we find the characteristic tendency to aberration from type strongly exemplified. Packard quotes an instance of a great South African myrmeleon, which, in the appearance of its wings, as well as in its manner of flight, resembles a huge moth, instead of a delicate cousin of the dragon flies. Packard, moreover adds to the heterogeneous characters of the order, by including in it two families that are frequently grouped into an order (called the *Thysanura*) by themselves. Every one knows the little silvery scaled, wingless fish-insects, with three bristles as a tail, that are to be found in dark and damp recesses, and amongst sugar and sweetmeats. One would scarcely imagine these *Lepisma* to be neuropters, yet Packard considers them as such. Be this as it may, we may well ask what is the meaning of this difficulty we have in fixing the limits of the neuropterous order? Why is it that we are obliged to include in it so many forms that seem to belie their natural affinities? It is because this order is the lowest among the true insects, and thus tells us of an early stage of insect existence, when the characters that now serve to distinguish the various orders were still held in common by the general insect type; and when the latter itself had not yet become so distinctly marked out from the rest of the Articulate sub-kingdom. As each order was developed, it was so by its members becoming more and more specialized, adopting some characters to the exclusion of others.

The reader may infer from this that, geologically speaking, the neuropters are an ancient order, and he will not be wrong. Long before either this continent or Europe had assumed its present outlines, (although these were even at that early period already foreshadowed), we find that neuropters must have abounded in the swampy forests, from which our coal was formed, and even in those that preceded them, on the shores of Devonian seas. What a ray of sunshine, of aerial life and reality, does not the finding of the impression of the delicate wings of huge flies, claiming kinship with our graceful and brilliant acquaintances of to-day, cast upon the dimness of that distant time! But to the naturalist, these wondrously preserved imprints are of great significance. The strange combination of characters which they present, puzzling him not merely as to their family position, but frequently leaving him in doubt even as to the order to which they belong, is what he has to expect. Each newly discovered fossil insect that comes to light is another link in the mysterious history of life upon the earth.

While writing the conclusion of this paper, a living specimen of one of our common large dragon flies (*æschna heros*) was brought to us. Wishing to show her mouth organs in operation, we offered her a house fly. Although held between our fingers, no sooner did she grasp the morsel between her jaws than she set to to devour it. That fairly masticated and swallowed, a second was tendered to her and disposed of, and twelve were thus very readily taken without intermission! As her appetite did not seem to abate, and as she was about two minutes disposing of each, we declined to serve our *demoiselle* with "another dozen," and let her go. To our surprise, she took wing without apparent discomfort after such a prodigious meal. If this was an instance of their normal appetite, it is clear that these creatures must be great benefactors to mankind.

Sleep Talkers.

An addditional element of interest is presented in those cases in which speaking is concerned, the somnambulist either talking or hearing what is said to others. Many writers mention the instance of a naval officer, who was signal lieutenant to Lord Hood, when the British fleet was watching Toulon. He sometimes remained on deck eighteen or twenty hours at a time, watching for signals from the other ships; he would then retire to his cabin, and fall into a sleep so profound that no ordinary voice could wake him; but if the word "signal" was even whispered in his ear, he was roused instantly. Dr. James Gregory cites the case of a young military officer, going with his regiment in a troop ship to a foreign station in 1758, who, when asleep, was peculiarly sensitive to the voice of his familiar acquaintances, and powerfully influenced by anything they said to him. Some of the other young officers, ready for any pranks, would lead him on through all the stages of a duel, or of an impending shipwreck, or of a sanguinary battle: each sentence spoken by them turning his dream (if it may be called a dream) into a particular direction; until at length he would start up in imaginary danger, and, perhaps awake by falling out of his berth or stumbling over a rope. In 1815, public attention was called to the case of a young girl who sometimes fell asleep in the evening, began to talk imagined herself to be a clergyman, uttered an extempore prayer, sang a hymn much better than she was accustomed to do at church, carried on rational discourse, and knew nothing about it when she woke. One of the somnambulists, or rather sleep-talkers, who have come under the notice of physicians, was a young lady accustomed to talk after she had been asleep an hour or two. If leading questions were put to her by any one in the room, she would narrate all the events of the preceding day; but her mind, sleeping or waking as we may choose to consider it, disregarded all questions or remarks except such as belonged directly to the train of thought. When she awoke, she knew nothing of what had occured. The Times, in 1823, gave an amusing account of the somnambulism of one George Davis, a youth in the service of a butcher in Lambeth. He fell asleep in his chair one Sunday evening; soon after he rose up in his sleep, with his eyes closed, fetched his whip, put on one spur, went to the stable, failed to find the saddle, and got up on the unsaddled horse. Some members of the family, watching him, asked what he was about to do; he answered that he was "going his rounds." With some difficulty they stopped him but could not stop his train of thought; for he entered into a wrangle with an imaginary turnpike man for giving him short change, saying, "Let's have none of your gammon!" Although now dismounted, he whipped and spurred vigorously as if really going his rounds.

For the fabrication of an article called sponge paper, lately patented in France, evenly and finely divided sponge is added to ordinary paper pulp, and this is worked as in the common paper making apparatus, into sheets of different thicknesses. It is said to have all the peculiarities of sponge, absorbing water readily, and remaining moist a long time. It has been used as dressing for wounds with considerable advantage and is capable of several important technical applications.

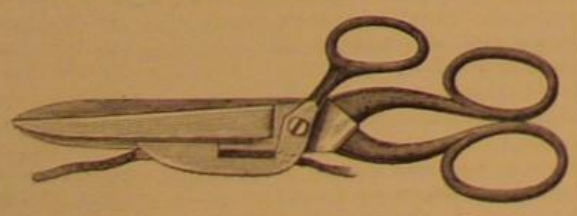
Traction Steam Engine Races.

A novel competition as to speed between traction engines was recently inaugurated by the Royal Agricultural Society at Barnhurst, England. A course had been staked out, 3,168 yards, or 1¾ miles, long, the greater part of which was rough and uneven, with three or four ugly "dips" and circuitous lines to render the competition as severe as possible.

Messrs. Aveling and Porter commenced the race with their 10 horse locomotive boiler traction engine, having 10 inch cylinder, and 12 inch stroke. The engine weighs 8 tuns, and to facilitate its locomotive powers over soft ground, the tires of the two main wheels are studded with "clips" and "spurs," to give the wheels a firmer hold, and prevent their slipping. The engine was driven and steered round the course by a youth named Hillman, about seventeen years of age, and he accomplished the whole journey, including the necessary stoppage, in 28¼ minutes. The same firm afterwards ran an engine called "The Sapper and Miner," being typical of the class of engines used by the artillery and engineer corps at Woolwich. It is 6 horse power, having a 7¼ inch cylinder and a 10 inch stroke, and its total weight is a little over 5 tuns, 4 cwt. The lad Hillman again acted as driver and steerer, and from starting to finish the time occupied was 21 minutes. Mr. Charles Burrell, of Thetford, Norfolk, was the next competitor, and he sent on to the course an engine of 8 horse power, with locomotive boiler, and having ordinary road wheels. It was driven and steered by two men—one to each duty—and the time occupied in going round the course was 29 minutes. The same engine made a second run, and accomplished the distance this time in 22 minutes and 25 seconds. Mr. C. Burrell afterwards tried an engine with vertical boiler, fitted with the elastic tires known as Head and Thompson's patent. These consist of a thick band of india rubber, cased on the outside with a kind of serrated armour plating, or cross tires of iron. During the progress of this engine, the driver received a sharp blow on the mouth from the handle of the wheel. This unfortunate mishap caused a considerable delay, including which the distance was accomplished in 27 minutes. A second run was made with the same engine, when it accomplished the journey in the shortest time occupied during the day—namely, 15½ minutes. The firm of Ransome, Sims & Head came next with one of Thompson and Head's engines, made by themselves; the wheels were fitted with the elastic tires, and the engine bore the name of "Sutherland," from the fact of its having been made for the Duke of Sutherland. The engine was of 8 horse power, and was driven by one man, with Mr. Head himself in front as steerer. Time, 24¾ minutes. In a second run, over the same course, the distance was accomplished in 23 minutes. After this, Messrs Fowler & Co. ran their three wheel engine, with locomotive boiler, 6 horse power. The engine was driven by two men, and went round the length of the course in seventeen minutes. Messrs. Amies and Barford followed with an 8 horse locomotive (made by Messrs. Tuxford, of Boston), driven by two men. The engine made an excellent start, and was traveling at a uniform good pace, but being steered too close to the soft bank of a ditch, it stuck fast, and after several endeavors to draw back, it was found impossible to continue the race with any hope of success. The victory in the contest was awarded to the second engine, driven by the lad Hillman, and belonging to Messrs. Aveling & Porter, in whose employ he has been for the last five years.

COMBINED SCISSORS AND BUTTON-HOLE CUTTER.

We illustrate in the accompanying engraving a combined scissors and button-hole cutter, invented by J. A. Althouse, of New Harmony, Ind. The button-hole cutter is formed by



a third blade, as shown, and its operation is sufficiently explained by the engraving. It seems a very useful addition to a lady's workbasket.

Science in Plain English.

William Rushton, of Queen's College, Cork, writing in *Nature*, under the above heading, says: "The learned will have to revise the method of teaching. There is a well founded suspicion that the course commonly pursued has been wrong in principle. The teachers proceeded from generalities, constructed very pretty systems, and dealt largely in refinements. Many people now believe, on the contrary, that we ought to begin with individual instances, then lead the pupil to construct a broad outline, and gradually to fill up the picture as his knowledge advances.

"Or, take another illustration. If a man works his way up the mountain side, he meets with many difficulties, but at length, when he reaches the top, he enjoys a fine prospect all around. Now, if that man wishes to guide others up the mountain, it is not sufficient for him to harangue from the top, or to dilate upon the fine prospect which he enjoys. He must come down again to the valley; he must take others by the hand, and lead them by the way he took himself, or very nearly by the same way.

"Until recently, elementary treatises on science were written from the top of the mountain. The authors, enjoying an expanded prospect, were disposed to take general views; and to discuss principles which, however interesting to themselves, had little or no interest for the pupil. There was a want of sympathy with the learner. For example, the writers on geography began with the globe, and expounded the elements of spherical trigonometry and astronomy, talking of meridians, parallels, the tropics, the equator, and the ecliptic. At present the best teachers of geography to young children begin with the place where the pupil lives and dwells; thence they proceed to the surrounding districts, to neighboring countries, and end with the globe.

"Bacon says that 'wherever it is possible, knowledge should be *insinuated* into the mind of another in the manner in which it was first discovered.' If this principle were fairly carried out, it would work great changes in our methods of teaching."

DEVICE FOR SUSPENDING AND ATTACHING ARTICLES.

In many kinds of business it is necessary to hang articles at a considerable elevation for purposes of display. This is particularly the case in retail stores, where a great variety of goods are sold, the upper ceiling being often made to answer the purpose of a show case to exhibit the wares of the proprietor. It is inconvenient to climb a step ladder every time one of these articles is to be reached or replaced. The inventor of the device illustrated herewith has provided an instrument for the detaching of articles from their supporting nails, hooks, or shelves, and replacing them again, which will obviate almost wholly the employment of the step ladder, and while it is cheap, must also prove very serviceable.

It is a hooking rod, having a hook-receiving socket for the elevation of the hook to its place of suspension, or clearance therefrom when suspended, in combination with a detaching horn, and hook keeper, all attached to a common handle, as shown. It is the invention of Wm. C. Lane, of Greenpoint, N. Y.

Correspondence.

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

Mechanical Equivalent of Zinc.

To the Editor of the Scientific American:

Dr. Vander Weyde, in discussing my article on the mechanical equivalent of zinc, goes over the old stereotyped formula so familiar to every student of electro-dynamics, and after thus occupying a column of your paper, comes to what he styles my *experimentum crucis*. As this was the only legitimate matter at issue, as far as I was concerned, he begs the whole question when he makes the plea that if I am right, then zinc is cheaper than coal, as an agent of power.

The reason I say 120 magnets, and not 2,000,000, is because such a magnet as I describe requires just the 120th part of a second to attain, under the action of the specified battery, a lifting power of fifty pounds. In using 2,000,000 magnets, the current would only have $\frac{1}{2000000}$ of a second to magnetize the limbs, not a sufficient time, I should think, to do the required duty. Are you answered?

Why will you, Doctor, under a great parade of figures, attempt to cover up plain facts? I do not write for "amusement," but in defence of myself, and in behalf of common sense and rational progress. See now, how easily I will expose the quackery of your analysis of my article.

The magnets in question acquire, in the 120th part of a second, a lifting power of 50 pounds. The perturbations induced by breaking the circuit require seven seconds of time to come to rest. Now any attempt to repeat the lift on the group of 120 magnets in less time than seven seconds, will result in failure, as the perturbations will interpose. But if we arrange seven groups of 120 magnets each, under such conditions that the current passes successively through each group in one second of time, it will be perceived that each group will have its rest of seven seconds, and the process can be continued as in any other motor.

It is not "absurd to think that the consumption of zinc will not increase with the labor performed." It is not absurd to think so, because it is the truth. Place a galvanometer in circuit with your electro-magnet; if there be any vibration of the needle on the approach of an armature under resistance, it will indicate a reduction of battery force. The fact that more zinc has been consumed in doing work than when not working, is due, not to the necessity of calling on the battery for more currents to do more work, but to the wrong construction of the engines, which generate forces antagonistic to, and destructive of the battery.

To show you, Sir, how entirely out you are as to battery duty, I will cite an experiment of an eminent electrician. (You will obtain his name from the Editor of the SCIENTIFIC AMERICAN.) He was trying some experiments very lately with a voltameter. With a very short circuit, he obtained a given result; without any modification of his battery, but by simply increasing the length of his circuit, he nearly doubled the result; or, in other words, the more work done, the less zinc consumed.

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

Atomic Motion.

To the Editor of the Scientific American:

It is now generally supposed that the atoms of all bodies are in constant motion, the speed of which can be calculated approximately for bodies which are in a gaseous condition. In gases, this speed is fully independent of the pressure of the gas, but varies in different gases inversely as the square roots of their specific gravities. Heat decreases the specific gravity by expanding the gas, therefore heat tends to increase the speed of the atoms, following the law alluded to, as air or gas with higher temperature may be considered as another gas with less specific gravity. The velocity of the atoms of hydrogen at a temperature of 15° Cent. is 2,409 meters, using for the calculation the co-efficients from Zeuner's "Wärmetheorie." If we compare these results with those obtained by experiments on the speed of sound, we find a striking similarity.

The speed of sound is independent of the pressure of the air or gas by which it is transmitted, but increases with the temperature; and, in different gases, it increases inversely as the square roots of their specific gravities.

At 15° Cent., the velocity of sound in common air is 340 meters, and as the specific gravity of hydrogen is 0·06926, the sound is transmitted through hydrogen of 15° Cent., with a speed of 1,292 meters, this being about half the speed of the atoms.

Hydrogen being probably the most permanent gas, I thought it preferable for this comparative calculation. I would ask therefore the following questions:

Has the speed of sound any relation to the speed of the atoms? Can errors during experiments account for the difference, 1,292 not being exactly half of 2,409? Does the increased speed of transmission of sound through water and solid bodies indicate a greater speed of the atoms in those masses?

I think an investigation on this subject would not be without interest. FENGO BILGRAM.

Philadelphia, Pa.

Cast Iron Wheels.

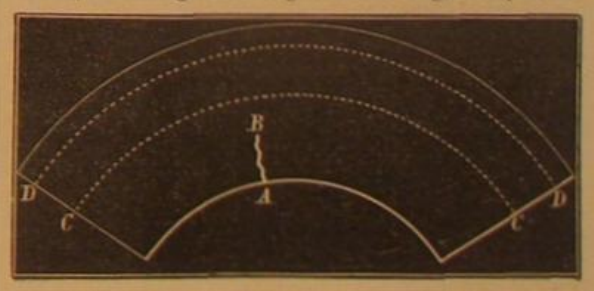
To the Editor of the Scientific American:

In your issue of July 8th, a querist, L. A. P., says that the cast iron wheels he is making, all burst asunder after being taken out of the sand, and when quite cold.

This is quite a common occurrence, and does not speak very well for the constructing departments of engineering establishments. And had your correspondent employed some competent engineer to construct his wheels, he would no doubt have been spared the vexatious trouble of casting them over and over again, and have saved considerable expense, and added to the reputation of his establishment. Of course it was bad proportioning which caused them to break, or, in mechanical parlance, "strain" in cooling; for although they did not break until they were taken out of the sand, as he says, "quite cold," the mischief was done before; and although he might have prevented the breaking by properly exposing the thick parts while quite hot, the strength of the wheels would have been greatly impaired, in fact, nearly destroyed; and therefore the wheels would not be safe in use. It is well known that we cannot remove all strain in any wheels or segments of a circle; but by proper engineering we can reduce it to a minimum, and thereby render them practically safe.

This subject, although very important, seems to be utterly disregarded in a great number of small shops, and hence the trouble fo L. A. P.

In experimenting with a segment of a ring, of any mode-



rate thickness, and broad in proportion, like the annexed figure, we shall find that it contracts in lines parallel with the arc or circumference. Therefore if cast in very hard metal, it will be sure to crack as shown at A B; but if we reduce by cutting it at the dotted lines, C C, and cast it with the same kind of iron, the crack will scarcely be visible, perhaps not at all, till we plane it and apply some acid; we may then repeat the experiment at the lines, D D, and no trace of the crack may be found; but still, the strain is not destroyed, only reduced, for if the segment be broken and carefully examined, even by the naked eye, it will be found very different at the outer part of the section than at the inner. This subject is of great importance to our trade, and this letter might be extended but for fear of trespassing on your valuable space. E. M.

Mansfield, Ohio.

Co-operation.

To the Editor of the Scientific American:

We are running our establishment on the co-operative plan. We pay each of our employés the full market value for his services, and, in addition, we divide among them 10 per cent of the profits of the concern each year.

The system works admirably. If you were to call at our place, we think you would be warranted in saying that you had seen men working by the day as you had never seen men work before. A. S. CAMERON & CO.

New York city.

The Marine Aquarium at Brighton.

To the Editor of the Scientific American:

The population of Brighton, or "London super Mare," as it is sometimes called, has reached over one hundred thousand. This is certainly a fair number, when we consider that Brighton is neither a seaport nor a manufacturing town, but simply a sea-side resort, or summer and autumn residence. It was originally a fishing town; indeed its coat-of-arms consists of two dolphins. During the eleventh century the rents or "manorial tithes." were paid in herring or mackerel.

Whatever else may have contributed to its present size and prosperity, certainly upon fish is based its foundation. It is but just, therefore, that the inhabitants should pay particular attention and respect to the marine fauna, and this they are endeavoring to do in a most laudable manner by building a marine aquarium, which, besides being an ornament to the town, will serve for all time as a magnificent monument to science and art. This novel structure, now fast approaching its completion, is 715 feet in length, and has an average width of a hundred feet. It occupies the entire available space between the Chain Pier and the pleasure grounds known as the "Steine." The foundations have been laid below the level of the sea, so that the roof of the building is far below the level of the public promenade on the cliff.

The entrance to the main building is effected by descending a noble flight of granite steps 23 feet wide. These steps terminate in an open court, the dimensions of which are 60 feet by 40 feet. The front elevation of the building, which is 18 feet high, consists of five arches, with coupled *terra cotta* columns, cornice and mosaic frieze. The columns have red and buff *terra cotta* caps. Sculptured figures of sea nymphs ornament the keystones of the arches, and the appearance of the whole front is exceedingly chaste and appropriate. This court is flanked on the left hand by a dining saloon 45 by 35 feet. From this the visitor will enter the aquarium proper, and into a large hall, 80 by 45 feet in size, having a vaulted brick roof, supported by ornamental iron columns, the light proceeding from the roof. This is a truly palatial abode, where, in tanks and reservoirs filled with salt water, the fish tribes may be seen displaying their beauties and propensities, surrounded by the finest specimens of architectural designs in the way of carved marble and stone, and of all the glittering embellishments of varicolored tiles and bricks, of *terra cotta* and encaustic.

The aquarium proper is divided into three corridors. The first is divided again into nineteen bays, which are roofed over with bricks, groined vaulting of red and black or red and buff, alternately. The arches, ribs, and bosses are of Bath stone. The extreme length of the corridor is broken most effectively by a central square 55 by 45 feet, the groined vaulting forming a sort of cloister around the square, while the central portion is covered with an elaborate ornamental iron roof, partly glazed with antique colored glass.

But let us return to the corridor. The tanks are arranged on either side, twenty-eight in number, averaging in size from 11 feet by 20 feet to 55 feet by 30 feet. The whole front work of the tanks is of Portland stone, ornamented with appropriate devices of fish, shells, marine monsters, and aquatic symbols. These fronts are inclosed by plate glass of great thickness, secured to the stoneworks by waterproof cement. The surface of water to be shown in rear of the glass is 9 feet wide by 5 feet high.

A remarkable feature must here be noted, namely, that the light of the corridors will only be transmitted through the water, thus affording to the visitor the sensation of being under water without the inconvenience of a wetting. At the eastern extremity of this corridor, which is 220 feet in length, the visitor finds before him the entrance to a fine conservatory. This entrance is at the junction of the first and second corridors; the latter, running north and south, forms right angles with the first corridor. The conservatory is 160 feet long by 40 feet wide and 30 feet high. The ornamentation of this apartment is in keeping with that of the other parts of the building. It is chiefly intended for a sort of subterranean promenade; it will be ornamented with plants, ferns, small aquaria, etc. Adjoining it will be constructed a kind of grotto, which, when filled with rock work, will form a pleasant variety to the other part of the exhibition. On the north side of the conservatory, or the present cliff wall, additional rock work is to be placed. In front of this will be arranged a series of shallow tanks to illustrate the culture of salmon.

From the conservatory we return to the second or transverse corridor. The size of this apartment is 80 by 23 feet, with the same architectural details as those in corridor No. 1. No tanks will be found here, its chief use being as an approach to the third corridor and a means of access to the terraces, which are built over the corridors, and are reached by flights of stone steps from the corridor, as well as by a similar flight from the entrance hall. These terraces may be used as promenades, if any one chooses to encounter the glaring hot sun above, and its reflection on the sea in front. Corridor No. 3, which is approached from No. 2, is of the same length as the conservatory, contains twenty tanks, some intended for fresh water, others for salt water, fishes. The fronts of these tanks are constructed of Ransome's patent stone.

At the end of this corridor are located the engines and the store tanks, boiler, retiring, and naturalists' rooms, and another flight of steps leading to the terrace.

The water for the tanks will be supplied by means of pumps, from reservoirs beneath the floor of the building; and, by a most complete arrangement of pipes and pumping, the water will be kept constantly in motion throughout the aquarium. To the south, the aquarium is sheltered against any encroachments of the sea by a substantial stone sea wall, which now serves as a public promenade.

The whole extensive work will be finished and opened before the close of 1871, at a cost of $250,000.

G. F. CANTINI.

Brighton, England.

Electro-Motors---The Paine Engine.

To the Editor of the Scientific American:

It is no theory, but a fact, well known in telegraphic circles for the last fifteen or twenty years, that a perceptible time is required for the charge and discharge of electro-magnets, and the larger and longer the core, the greater the time necessary for its full action. Flat cores have been tried, and quite a number of hollow ones were used some twelve years ago; but all have been found subject to this same law of time. For this reason, principally, magnets in use at the present day are smaller than those formerly employed. Still the action of these is not instantaneous, as any of your readers may see for themselves by visiting a telegraph office, and getting the operator to make some of the following experiments:

1. If, during the transmission of telegrams from any point, he will gradually increase the tension of the spring which draws the armature from the magnet attached to the main circuit, a point will be reached where not a single dot will appear, but every dash will make itself known on the sounder or register. The duration of the current for the dot is fully one twelfth of a second, yet here every one may see the naked fact, that this is not sufficient time for these small magnets to acquire their full power. The time the current is applied for the dash is about one quarter of a second, and it is also a fact that this produces a stronger magnet than when the current is applied only one third of this time.

2. If the line can be found idle, let the operator resume the ordinary tension of spring, so that dots will appear when the key is manipulated with the usual speed. Now if he will close circuit by giving his key a quick strike, no matter how hard, the magnet will again fail to move its armature, because too little time has been allowed it to charge.

3. Notice the sound made by the armature of the register or sounder when the current is opened and closed in the usual manner. Now hold this armature away from the magnet until the circuit shall have been held closed for a second or more, then let it slip quickly out of the grasp, and the sound thus produced will be found to be two or three times as loud as that made by currents of much shorter duration.

4. Moisten the thumb and fingers of one hand, and hold them on the binding screws of the local magnet, while the operator sends a series of rapid currents through it. Shocks of greater or less severity will be experienced, but they will be found much more powerful when the current is opened and closed slowly, as the magnet, in the latter case, becomes more highly charged, and consequently by its discharge generates a current of greater intensity. (The current from the battery gives no shock).

Any one who will take the trouble to witness such facts can easily see through the fallacious reasoning that Mr. Paine wishes to be accepted as "clear and unmistakeable" proof. On page 36, current volume of the SCIENTIFIC AMERICAN, he argues that because a magnet will lift fifty pounds, it will therefore perform the same labor in the 120th part of a second. This is a bare assertion, not only wholly destitute of logic and fact for its support, but the truth of which is positively disproved by the *fact* that the smaller and quicker acting magnets on telegraph lines become only partially charged in the twelfth of a second, or ten times the time he allows the slower magnet he speaks of. He might, with just as much logic and truth, say that because a man can lift a barrel of flour at his leisure, he can therefore raise it in the 120th of a second, or 7,200 barrels per minute. With equal sense and truth he might argue that because one closing of a circuit, continuing a second, consumes one grain of zinc, 120 closings a second consumes 120 grains. Now it is not the *beginning* of the current that wears the battery, but the *continuation* of it; and so it is the proper *duration* of the current, and not a great number of mere beginnings per second, that results in much power. This is no theory; it is the universal declaration of magnets themselves.

The assumption that time is not required in electro-magnetism, leads to another absurdity worthy of note. It is a fact, not theory, that the greater the velocity of any body, the greater its momentum and the greater the force that sets it in motion. Therefore, when we see a magnet move fifty pounds one tenth of an inch in the 120th of a second, we know that magnet has more power than when it moves the weight in the 100th of a second. Mr. Paine thus gives to the world this new law in physics: "The shorter the duration of the electric current, the greater its magnetic effect."

It will be seen from this law that whenever any electro-magnetic engine, of whatever form, once begins to increase its velocity, it must keep on increasing until torn to pieces by its own force; for the greater the speed, the shorter the duration of the current; the shorter the current, the greater number of them per second; so that we not only multiply the number of electric impulses, but the power of each and every one in the same ratio.

I wish the readers of the SCIENTIFIC AMERICAN would carefully compare Mr. Paine's article, on page 36, with the following, and see what it is that he has proved by it.

Last winter I was permitted to see the wonderful Paine engine perform. In driving a circular saw through a spruce stick three or four inches thick, it ran faster than when only overcoming its own friction. Mr. Paine admitted the fact, explaining that as the labor reduced the speed of the engine, it gave the magnets more time to charge. He represented this little more time (though I could not see that the speed was first reduced at all) as enabling the magnets to gain enough more power to spring the strong circular cast iron frame in towards its center, thus bringing the two sets of magnets nearer each other, in consequence of which they attracted with greater force.

In a future communication I shall mention other little eccentricities of this engine, and relate my experience in experimenting with three others modeled after it.

J. E. SMITH.

Easton, Pa.

The Depths of the Sea---No. 3.

To the Editor of the Scientific American:

In the waters around the equator, which are more quiet and warmer than waters of higher latitudes, the *polypus* species, especially those known by the name of *Madreporæ*, are, in truth, building gigantic works. *Caryophillea*, *Meandrinæ*, and *Astræ*, species of *Madreporæ*, absorb muriatic calcareous earth, contained, in a fluid form, in sea water, and form firm, rocky reefs and cliffs of it. The *Madreporæ* choose generally the elevated plains of submarine mountains for their abode, because they cannot live when exposed to a very heavy pressure. Here they first build a range of cells, which the next generation covers with a second layer, and so they build on, layer upon layer, until the whole gigantic structure reaches the surface of the ocean. Here the work of the *Madreporæ* stops. In finishing and raising these reefs above the level of the sea, Nature displays another wonderful activity. Around the new formed reefs the ever toiling surges nibble incessantly, wash off parts, which then float towards the center of the cliffs, and in this way become enlarged by contributions from the outside. Sea plants torn off from the shores, during flood, branches and trunks of trees, eradicated by rapid streams, and carried along in their course, gather and accumulate on these vast nets of stone, putrifying here gradually; and thus are forming the first traces of a layer of earth favorable to vegetation. Grains of seed, carried hither by the waves of the sea, are landing, from every direction, upon this new soil; ferns, grasses, moss, lichens, etc., cover the sides of the rocks with a green garment; other plants are suddenly sprouting forth from under the first named species, among others, perhaps, the cocoa tree, owing its appearance perhaps to the playing hands of a child, who threw down the seed from a high cliff, many miles distant. Thus is gradually rising, like an oasis in the desert, in the midst of the sea, a new island—on which sea birds are building their nests, where flocks of seals come to warm themselves in the rays of the sun—a new and beautiful island, only waiting for man to give it a name, and a dignified life, to deliver its treasures to the coming generations.

Upon all the submarine mountain chains, from the western coast of America to the Cape of Good Hope, the *Madreporæ* are building myriads of small isles, all of them nearly extending to the level of the sea. They surround Australia, like a gigantic wall, and form on its eastern coast an immense reef, with a length of about 600 miles, which hinders the passage of any vessel, and threatens to make gradually a considerably larger extension. Another *Madreporæ* bar is nearly uniting New Guinea with the Fifth continent (Australia), leaving only a space of a few hundred miles between them; and the time when this madrepore isle will form a part of Australia is easily to be foreseen.

Another work of the *polypus* species commences in the Indian Ocean, near the center of the coast of Malabar, from the archipelago of the Laccadive and Maldive isles, and is extending beyond the equator down below the Ischagos islands, etc. In the midst of the Pacific Ocean, the *Madreporæ* are working with extraordinary perseverance, on the formation of a new continent.

Thousands of islands which constitute the highest peaks of submarine mountains, owe their origin to these diminutive animals; and from day to day the space, which separates one of these isles from another, grows smaller. The inhabitants of these numberless groups of islands can already come from the extremity of one to that of another, by following the reefs, which, in many places, form broad high roads on the surface of the water.

The inhabitants of the Feejee isles travel on such madrepore reef roads in the midst of the ocean, to the Samoan isles, by putting up at night on those peaks, which tower above the water.

But a great many other mediums, besides the *polypus* species, are active in the formation of new continents from ruined ones. Violent earthquakes, shaking the depths of the sea, finish the work set in motion by those feeble animals. It is a known fact, that sometimes in the midst of the sea, vast pillars of fire and smoke are rising, which are lava masses issuing from submarine volcanoes. It is also well known, that earthquakes are much more frequent on the bottom of the sea than on the firm land; and that, during such earth revolutions, small isles often rise above the level of the sea, while others disappear.

The surface of the madrepore works is formed undulatory, or towered up to hills or real mountain chains, when standing upon a soil under which such shocks of earthquakes take place. Some of the horizontal layers change their position into vertical walls, and form now picturesque elevations clothed in green; breaking the violence of the storms, attracting the clouds passing over them, and thus producing the fountains of the forests, brooks, and creeks, which unite to form streams; and now breaking their beds through the mountains, fertilizing the soil, and supply man with sweet, wholesome water.

The Maldives, Marquesas, Palcos, and thousands of other

islands, are works of the *Madreporæ* and other *polypus* species, which were assisted by earthquakes. The soil of all Australia is of this formation, and we may therefore justly expect that its area will grow larger every year. The *polypi* do not only form new continents now-a-days; we still owe to them important tracts of soil in older countries of our globe. Remains of shells and madreporic formations of stones fill, almost everywhere in the primitive rock, large basins, which are regarded by our geologists as the primitive bottom of the sea, filled up mostly by *polypi* and testaceous animals. Such immense aggregates and the incessant work of these microscopical creatures, which are designated to change the shape of the surface of the earth, yes, even transpose the ocean's bed, are worth the most earnest, profound study and investigation. One day all the thousands and thousands of islands in the Pacific Ocean will be united by the incessant work of the *Madreporæ;* one day an immense new continent, larger than all hitherto known, will rise in the Pacific, to which continent the inhabitants of our present world may sail, perhaps 5,000 or 15,000 years hence, to save themselves from the ice and water, which advances more and more from the north.

Of course such an epoch cannot be determined minutely; in Nature, centuries, thousands and millions of years are like the seconds, minutes, and hours of an hour glass!

AMALIE PFUND, *née* JANSSEN.

"Is the Brain the Origin of Thought, Intellect, or Mind?"

To the Editor of the Scientific American:

Under the above cited question, there appeared an article in your issue of May 16th. I have waited till now for an abler pen than mine to discuss the answer given by the writer of that article. My disappointment may therefore stand godfather to the request to give the following few words a place in your valuable journal.

The writer, while admitting the brain to be the seat of thought and intellect, considers them as the *secreta* of the "immaterial" mind. "The functions of the brain cells consist," he says, "in secreting thought from the immaterial mind." In diseases of the brain, that "immaterial mind remains as perfect as ever," and is "unharmed by disease of the material substance."

The writer further says: "People also generally regard the mind and soul as identical. If they were, then, of course, that would settle the question as to the brain being the origin of the mind. It could not be, for then it must be the origin of the soul. But that is impossible, as the brain is destroyed at death and the soul lives on forever. That which is mortal could not be the origin of that which is immortal."

The word soul, if it signify anything, can only be used as a collective name, to designate the sum of all psychical actions taking place in an individual; and while all psychical processes have their seat in the brain, so the brain must be the seat of the soul.

In an inseparable alliance with the body, the soul of men has to go through all the stages of slow development. The comparative empirical psychology of the animals shows to a certainty that, between the souls of the highest developed animals and the souls of men of a low scale of intellectual development, the difference is only a quantitative, not a qualitative one.

The doctrine of evolution of Lamarck and Darwin is the death knell to the artificial heterogeneity of power and matter, of soul and body, of the old dualistic philosophy. The foggy pictures of a mythological diction will disperse before the sunshine of scientific scrutiny, and the traditions of 1,000 years of ignorance and stupidity will sink into the dust before that mighty conqueror who has established his throne in the gray substance of the brain.

A new era dawns, which will bring us intellectual liberty, and the moral perfection of the human race, the contradictions and lamentations of a hard dying hierarchy to the contrary notwithstanding. M. S., M. D.

New Orleans.

The Application of Steam on the Canals---Method Used on the River Elbe.

To the Editor of the Scientific American:

While making the tour of Europe with my father, we found ourselves in Dresden, the beautiful and elegant capital of Saxony, in July of last year.

A most novel feature of transportation on the river Elbe, calculated to arouse the attention of every observant traveler, is the method of propulsion employed on the steam tow boats of that celebrated stream.

The freight boats that are there employed are usually either sloops or schooners, with their masts so arranged as to be readily lowered in passing the many bridges that span the river at Dresden and other cities on the shores. These sloops and schooners usually float down the river, from its highest navigable points, to the vicinity of Hamburg, simply by aid of the current; seldom spreading a sail before reaching tide water and a channel sufficiently wide to enable them to "tack" and beat to right and left. These vessels, then, are not only able to navigate the lower Elbe by means of their sails, but are freely used as coasters, and are often engaged in trade with England and other foreign countries.

On their return trips, up the Elbe, the narrowness of the river and the tortuousness of the channel render sails useless, and steam is ever necessarily employed, and it is to the method of its application here that I would draw your attention.

From six to a dozen of these sailing vessels are towed up the Elbe by one steam towboat, that is furnished with neither a paddle nor a screw. An immense chain, some seventy miles long, with its upper end fastened to the bottom of the river channel, many miles above Dresden, and its lower end secured in the same way, many miles below the city, passes through a roller or pulley at the bow of the towboat, or tug, is then wrapped around a large drum near the middle of the deck of the tug, and then passes back and through another roller or pulley at the stern of the tug, and thence into the water.

The steam power is applied to this drum, and the revolution of this simply winds the tug up stream, with all the boats that are temporarily attached to it; and all of this is accomplished with satisfactory speed, and without any commotion of the water of the river. As the current is considerable on the Elbe, and boats readily float down stream with the current, the towboats are here only used in towing up stream, and only one chain is employed; but, in a canal, on which vessels would have to be towed each way, two chains would be required, and this is the only difficulty in the way of the complete success of this method that I can imagine, even if there be this one.

The seventy miles of chain passing Dresden is divided into sections, stages, or relays, I think of even distances, and a tug or towboat is assigned to each section, although the chain is entire and undivided. When a brig arrives at the upper end of her route, she shifts the boats she is towing to the towboat that meets and relieves her from above.

I think what I have written will be readily understood by any one who feels an interest in this subject.

GEORGE T. ALLEN, JR.

Springfield, Ill.

Paine's Early Electro Experiments.

To the Editor of the Scientific American:

During the summer of 1857, Mr. H. M. Paine had a boat of twenty-two feet keel and four feet beam, with a stern wheel, running on a small lake in this vicinity. I have frequently been one of a party of ten or twelve persons in the boat when it was making six miles per hour. The motor was an electromagnetic engine which was easily brought from Mr. Paine's residence at the head of the lake by two men, and placed in position in the boat, and the battery, which consisted of nine Grove's cells, was set up under the stern sheets.

Since reading Mr. Rowland's letter in your paper, it has occurred to me that Mr. Paine might have had a concealed battery in the pond, or a trained turtle, or a muskrat.

In the spring of 1857, Mr. Paine occupied our City Hall during five consecutive nights in giving illustrations of electromagnetic power. He had shafting so arranged as to operate a large engine lathe, a card machine, and a small printing press, which were all operated by the same engine used in the boat, and the battery used consisted of eighteen Grove's cells. At the close of the last evening, he threw off the machinery and battery, and made a connection with the telegraph wires from Providence, R. I., which passed by the hall window, and got quite a rapid motion on the engine.

Now is it not possible that the operators in Providence or somewhere on the line may have been in collusion with Mr. Paine, and extra battery applied?

I most decidedly insist that Mr. Paine shall not be allowed to do such things without taking me, or somebody who knows as much as I do, into his confidence. And I call on your, friend Rowland, to go on with the good work.

Worcester, Mass. A. G.

Fast Steam Plowing.

A recent competitive trial of steam plows took place at Barnhurst, Eng., under the auspices of the Royal Agricultural Society.

In class I, for the best combination of machinery for the cultivation of the soil by steam power, the first prize was £100; 2nd, do. £50. Messrs. Fowler & Co. (Leeds) commenced, with two twenty horse engines and a thirteen tined cultivator. The pace at which the latter moved was 7 miles per hour, although penetrating to a depth of 7½ ins. The style of the work was splendid. In the short time of 41 minutes, a plot of three acres was finished to the perfect satisfaction of all who witnessed the operation. The following are particulars of the engines with which this work was accomplished:—Diameter of single cylinder, 13 inches; stroke of ditto, 14 inches; total heating surfaces, 278 square feet; average steam pressure, 100 lbs.; number of revolutions per minute, 130; speed of plowing rope, 2¾ miles; speed of road motion, 2 miles; driving wheels diameter, 6½ feet, breadth, 22 inches. The weight of engine complete and in working order, 17 tuns. After this, Messrs. Fowler experimented in another field with a 12 horse double set, and a 9 tine cultivator. In 58 minutes three acres were got over with this tackle, the average depth being 7½ inches. The third set of the same firm consisted of the clip drum tackle, with a 12 horse engine. The weight of the whole machinery was under 10 tuns, the boiler and working parts being made of steel. In this system the engine, instead of having its coiling drum beneath it, has its drum with a single V groove composed of small movable clips to prevent slipping. On the opposite headland, a self-moving anchor on 6 disk cutting wheels travels along as the work proceeds. The cultivator is hauled between engine and anchor, and *vice versâ*, by an endless wire rope passing round the clip drum of the engine, and the sheaf of the anchor. Three men and two boys worked this tackle, and three acres were accomplished in 90 minutes. Messrs. Fowlers' fourth set comprised an 8 horse single cylinder engine, fitted with two winding drums, one 6 disk anchor, 1,200 yards of rope, and 16 rope parters. The construction of this engine is peculiar, the tank and driver's place being over the fore wheel, the crank shaft being above the hind axle at the smoke box end. The boiler and main working parts were of steel, the total weight not exceeding 12½ tuns. The style and rapidity with which the work was performed were alike satisfactory.

Messrs. Howard, of Bedford, had entered, in Class I, a pair of traction engines fitted up with their new safety tubular boilers, and considerable excitement had been caused by the hope of seeing the great rival firms of Howard and Fowler in earnest competition, but unfortunately for Messrs. Howard, and to the great disappointment of the public, it was discovered that several cogs in one of the engines were broken. The stewards offered to allow Messrs. Howard to substitute another engine for the disabled one, but the firm decided to withdraw from the contest. The only remaining competitors were Messrs. Barrows and Stewart, who had a 12 horse engine, a 5 tine cultivator, and an improved Woolston tackle. A three acre plot was turned up, to an average depth of 8¼ inches, in 2 hours and 59 minutes. It will be seen that in this competition Messrs. Fowler came off with "flying colors."

Improved Photographic Process.--Dry Plates with no Preservative and no Washing.

The following are the leading particulars of a new collodion process, requiring no preservative and no washing of the plate until after the development. I have obtained some good negatives in this manner.

The collodio-bromide emulsion must contain an excess of nitrate of silver. All the soluble bromide in the collodion must be converted, and there must remain as large an excess of nitrate of silver as the collodion will contain. About six grains of bromide of cadmium and eleven grains of nitrate of silver to the ounce of emulsion will not be found bad proportions.

When all the materials used in the collodion are of the best quality, so that the emulsion is neutral or nearly so, one or two minims of glacial acetic acid to the ounce may be added with advantage; otherwise no addition of acid is necessary. There need not be more acid in the sensitive film than there is in an ordinary wet collodion film.

The plate is to be coated with the emulsion in the usual way, and then put into the dark slide or plate box until required for the exposure.

Under the best conditions of the film—that is to say, when it contains the minimum of free acid and the maximum of free nitrate—the sensitiveness will be about the same as that of good wet collodion.

The image is to be developed with a common acid iron developer, rather strong, and containing as much alcohol as is found necessary to enable it to flow properly over the dry film. This quantity will, of course, be greater than that which is commonly added to the developer in the wet process.

The image comes out very quickly, and must now be treated in the usual way as regards intensifying and fixing. The negative is indistinguishable, when finished, from a common wet collodion one.

This process offers great advantages to the tourist, because it requires no nitrate bath, no troublesome washing of the plate, no preservative, no subsequent drying, and no wetting of the plate before development. The emulsion may be kept in two separate parts—one consisting of the collodion with the bromide of cadmium, the other being an alcoholic solution of nitrate of silver; these may be mixed as required for use. The film adheres well to the glass without any preliminary coating, and there are no troubles with blisters, or wrinkling, or tearing of the film.

It must not be supposed that this process is a modification of Mr. M. Carey Lea's chloro-bromide process with alkaline development, for the two have not a single feature in common. It is a modification of one very much older than Mr. Lea's, and to which it bears an exceedingly close resemblance, namely, that of Captain Dixon, which was patented about ten years ago, and which I had the pleasure of working with him. The only marked difference between this process and his consists in his emulsion being composed of collodio-iodide, and mine of collodio-bromide, of silver.

I have only to add that no special pyroxylin seems to be necessary for this process any more than for wet collodion.—*Thomas Sutton, A. B., in the British Journal of Photography.*

Laws Relating to Newspapers.

We have been asked to give the law, as it stands, relating to newspapers and subscribers:

1. Subscribers who do not give express notice to the contrary are considered wishing to continue their subscription.

2. If subscribers order the discontinuance of their periodicals, the publishers may continue to send them until all arrearages are paid.

3. If subscribers neglect or refuse to take their periodicals from the office to which they are directed, they are held responsible until they have settled their bills, and ordered them discontinued.

4. If subscribers move to other places without informing the publishers, and the papers are sent to the former direction, they are held responsible.

5. The courts have decided that refusing to take periodicals from the office, or removing and leaving them uncalled for, is *primâ facie* evidence of intentional fraud.

6. Any person who receives a newspaper and makes use of it, whether he has ordered it or not, is held in law to be a subscriber.

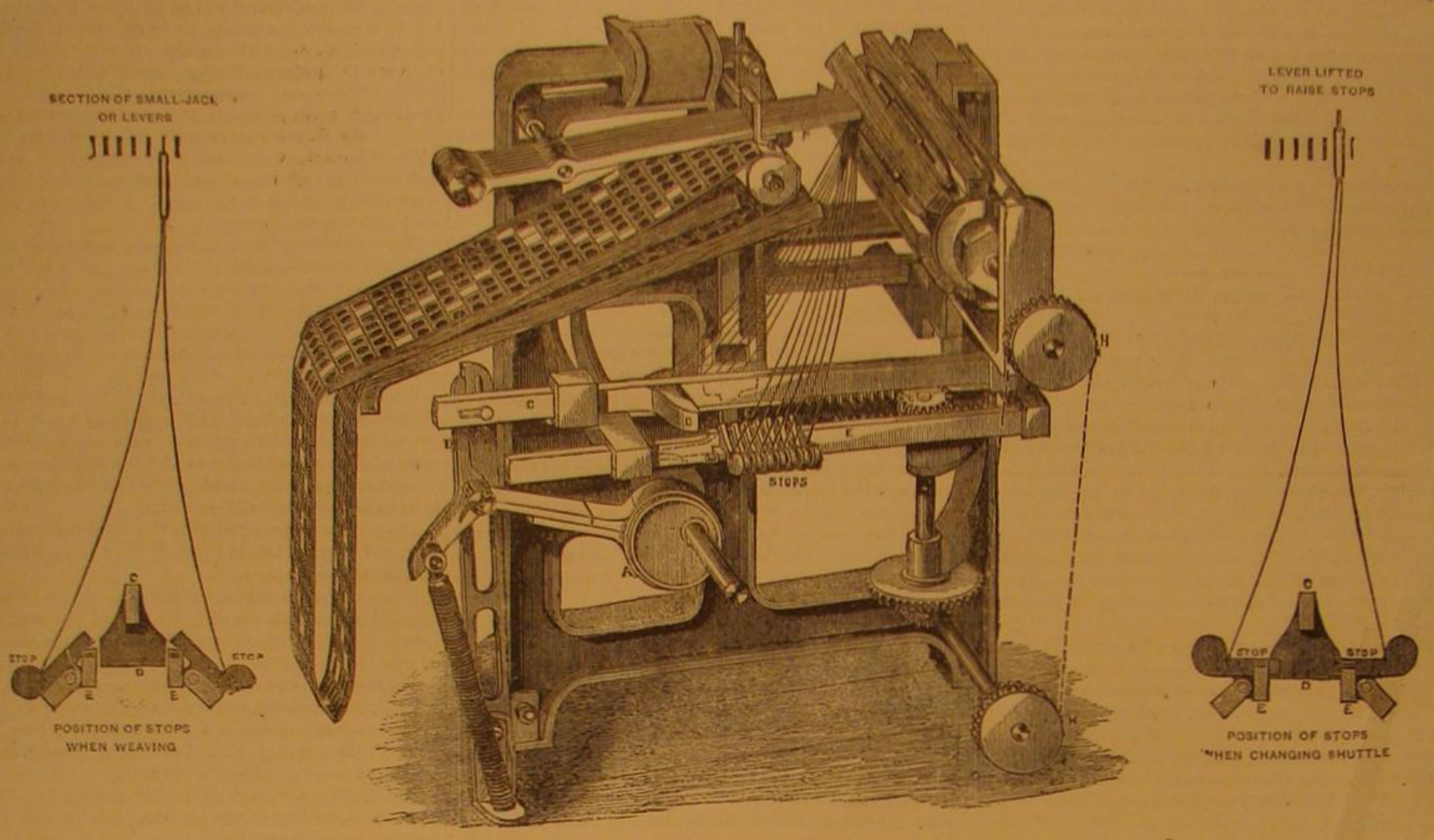
TO CLEAN BLACK CLOTH.—Dissolve one ounce of bicarbonate of ammonia in one quart of warm water. With this liquid rub the cloth, using a piece of flannel or black cloth for the purpose. After the application of this solution, clean the cloth well with clear water, dry and iron it, brushing the cloth from time to time in the direction of the fiber.

Circular Shuttle Box Loom.

The loom illustrated in the annexed engraving manufactured by Messrs. J. Harrison and Sons, of Blackburn, England is what is known as a circular shuttle box loom, with skipping motion, six shuttles and loose reed; and it is the means employed for actuating the circular shuttle box, so as to bring any one of the six shuttles into operation as required by the pattern, which forms the object of the invention. The circular shuttle box is mounted in the usual manner on an axle at one end of the sley, and has a positive revolving motion given to it, when required to change a shuttle, by a chain actuated by gearing in connection with two racks, the amount of motion being regulated by tumblers connected to jacks or levers governed by Jacquard cards

instrument, which is highly spoken of by those who have examined its construction and listened to its tones.

The sounds are produced by the hammers striking upon steel hooks of a peculiar construction. These hooks have three prongs, the centre one being used to attach the hook firmly to a metallic support. The outer prongs differ in length, and herein lies the value of discovery. When struck, the hook gives out not only a pure sustained tone, but a perfect harmonic. It is said that the high notes have all the brilliancy of strings, but, in descending the scale, the tones approach the *timbre* of wind instruments, like the organ. The purity of tone throughout makes other musical sounds comparatively coarse. It is continued and singing, and its volume is regulated by the touch of the player and the pressure of the pedal; its only harmonic is the octave. Its simplicity, durability, quality of tone, and possible cheapness of construction, point it out as a useful instrument.

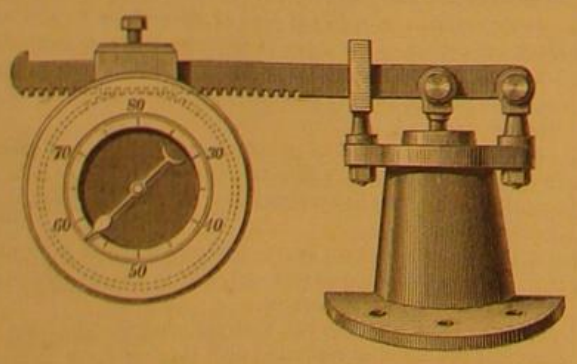


CIRCULAR SHUTTLE BOX LOOM.

A is an eccentric connected to a lever, B, for giving motion to the sliding bar, C, furnished with projections, D, which act upon tumblers E when they are lifted by the cards connected to the jacks or levers. F, which is whenever there is a blank in the part of the card opposite to the jack or lever. When these tumblers are lifted they fall into slots in the racks, and being caught by the projections, D, the racks are carried forward and the pinion, G, turned; this gives motion to the upright shaft and bevel wheels, through them to the chain wheels, H, one of which is on the axle of the shuttle box. Each jack or lever, except the two end ones, is connected to two tumblers, one on each rack; and as the racks are on opposite sides of the pinion, the tumbler gives motion to the rack on one side, and the other tumbler acts as a stop, and regulates the exact distance that the opposite rack and consequently, the shuttle box moves.

SAFETY VALVE LEVER.

William Henry Bailey, of Albion Works, Salford, England has patented the neat arrangement of weight and safety valve lever of which we give a sketch. According to this plan, the underside of the lever is formed into a rack, and as the weight is moved outwards or inwards on the lever, this rack gives motion to an indicating finger which shows the pressure per square inch to which the valve is loaded in each



position of the weight. The patent also includes a claim for "marking on the dials of pressure gages the temperature corresponding to the various pressures indicated by the said gages.

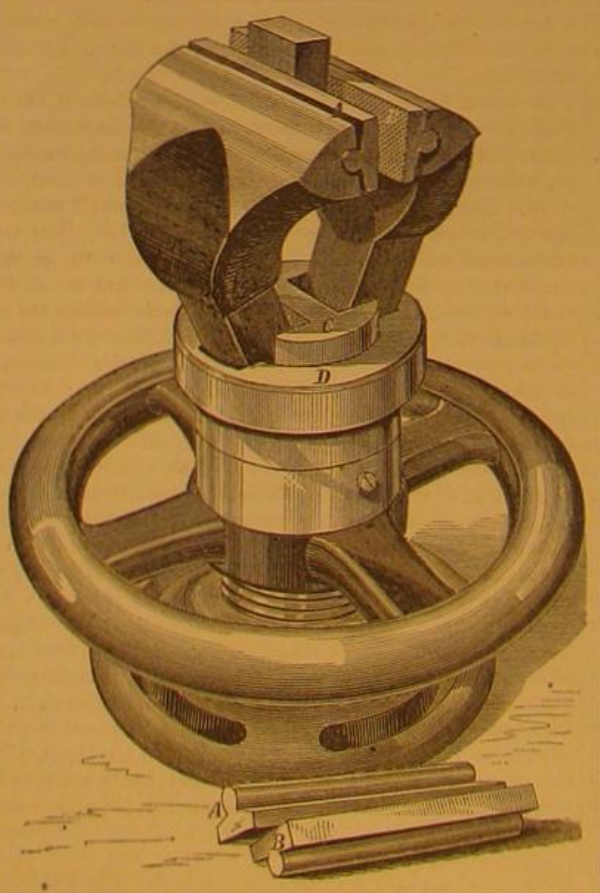
The last claim cannot, we think, be sustained, as we are certain that it is not a novel feature.

New Musical Instrument.

Among the recent patents is one granted to Thomas Atkins and Henry Drewer of Cincinnati, Ohio, for a novel musical

HILDRETH'S UNIVERSALLY ADJUSTABLE VISE.

Among the most important of bench tools must be ranked the vise. With the hammer, the cold chisel, the file, square, and rule, it forms almost the very foundation of the outfit for the machinist, while it is equally important in other branches of mechanical industry. Any improvement there-



fore, calculated to widen its sphere of usefulness, will at once arrest the attention of all mechanics.

We illustrate in the accompanying engraving an improved form of this implement, by which its usefulness and convenience are very much increased, through exceedingly simple and compact devices. In this improved form, objects may be held in any position most convenient for the workman in chipping filing, etc.; and wedge shaped objects may be held either horizontally or vertically, the jaws of the vise adapting themselves to the inclined surfaces embraced in either position. The manner in which these ends are attained will be evident on inspection of the engraving, in which A and B represent removable jaws, B, when in position, being fixed, and A, oscillating upon the circular rib at the back, which connects it to the large jaw of the vise; this gives the proper adjustment vertically for objects with either parallel or inclined sides. C is a standard, slotted as shown for the reception of the jaw levers. D is a collar which, when forced upward, compresses the jaw levers together. This collar is moved upward when the vise is used, by means of a hand wheel, the hub of which is a nut running in a strong screw thread cut in the standard, C. The gripping power of the vise is thus compounded from the principles of the screw and inclined plane, by which means it obtains an extraordinary holding capacity.

The lower portions of the jaw levers are so constructed that, by running down the nut, closing the jaws, and turning the collar partly round to release them from the slots in the collar, they will turn sufficiently on their vertical axes to adjust themselves to wedge shaped bodies placed horizontally. When thus used, the collar is forced up by the nut, in the same way as when the jaw levers are placed in their proper slots in the collar, and the vise is employed for holding objects with parallel sides.

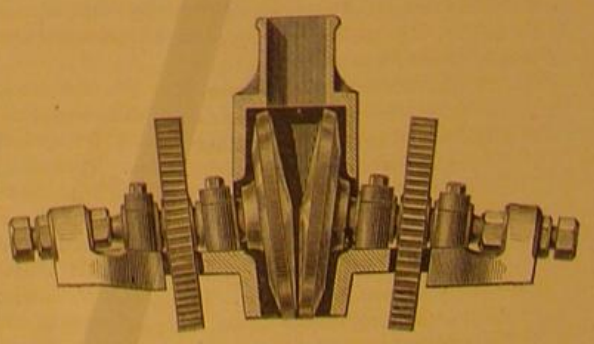
Finally, the entire vise can be adjusted on its vertical axis by loosening the bolts which attach it to the bench, and turning it into the position required, the base plate which supports the standard, C, and the other working parts being slotted concentrically to receive the bolts.

The convenience of these several adjustments will be obvious to every practical mechanic.

Patented through the Scientific American Patent Agency, November 1, 1870. For further information address the patentee, R. S. Hildreth, Laurens, N. Y., or Bent & Goodnow, 490 Washington St., Boston, Mass.

ORE AND STONE CRUSHING MACHINE.

The annexed engraving is an illustration of an ore and stone crushing machine, patented by Ferdinand Oliver Cam-



roux, of Deptford, and George Oliver, of Wapping, England. It consists of two conical faced disks, keyed to inclined shafts, having powerful set screws to adjust the width of space between the disks. The ore or stone is fed into a chute, and, falling between the inclined disks, is subjected to pressure as it passes into the gradually contracting space, and is thus crushed.

NATURE—the living garment of God.—GOETHE.

Scientific American.

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PATENT LAW REFORM IN ENGLAND.

At a recent meeting of London patent agents, the following resolutions were adopted:

First.—That the chief defects of the patent laws have arisen from a want of appreciation of the *natural* rights of inventors to the sole use of their inventions, an unreserved recognition of which rights must pervade every equitable patent system, and the true aim of patent legislation is to harmonize these individual rights with the material interests of the State.

Second.—That the grant of patents to mere "first importers" is an injustice to inventors, an injury to society as it induces the "pirating" of inventions, and the reason for these grants no longer existing, legislation should confine the issue of patents to actual inventors and their representatives.

Third.—That, in view of the benefits inventors confer on the public, and the expenses incident to the completion and introduction of new inventions, a patent for fourteen years is an inadequate compensation, and we deem it expedient to grant patents for a term of twenty-one years without the privilege of extension.

Fourth.—That the patent laws impose *penalties* upon inventors in the form of excessive fees, which justice and public policy demand should be reduced to the amount requisite to defray the expenses of an efficient administration of a simple patent system, and fees of ten pounds for the entire term—now one hundred and seventy-five pounds—would yield more than sufficient for thepurpose.

Fifth.—That the defects of the present practice should be remedied by the adoption of equitable "regulations," and the introduction of the system of granting patents, at the risk of the applicants, without any official supervision of the specification or preliminary investigation of the merits of the invention.

Sixth.—That the rights of patentees should be determined by a competent tribunal, excluding all technical objections to the validity of the patent, and we deem it expedient to dispense with jurors and "scientific experts" in patent suits.

Seventh.—That these resolutions, signed by the Chairman, be forwarded to the Parliamentary "Select Committee on Letters Patent," and such other publicity be given them as he may deem conducive to the success of a liberal measure of patent legislation.

The above resolutions have been sent to us with a special request from the chairman, Mr. Haseltine, to give them space in our columns, and express our views editorially upon the subject, as it is the desire of the London agents to lay the opinions of the press before the members of Parliament. We take pleasure in complying with the request.

While we are in favor of patents, and are thoroughly convinced that no civilized nation can at present afford to abolish them, we see no reason why the real nature of the patent system in general should not be plainly stated.

We think that the London patent agents who, in the above first section, have resolved that the chief defects in the British patent laws are due to a want of appreciation of the natural rights of inventors to the sole use of their inventions, will have to revise their observations. There is no legitimate connection between the said rights and the said defects.

In every community the good man has an inalienable right to life, liberty, and the pursuit of happiness; he is also under natural obligations to contribute, by all that in him lies, to the welfare and prosperity of his fellow men. From these obligations no class of individuals is exempt. Therefore, to assert that inventors have a *natural right* to the *sole use* of their inventions is sheer nonsense. They have no such right.

The fact that one man makes a hat or a coat or any other device, in a new and peculiar way, gives him no natural right to interfere with the liberties of others in doing the same thing.

No man has a natural right to be a monopolist. The few have no natural right to lord it over the many.

Private monopolies, special privileges of all kinds, are created and enforced by the exercise of tyrannical power. They are antagonistic to the spirit of liberty, and in general, as history proclaims, damaging to the prosperity of any people.

But in some communities special monopolies are enforced as temporary expedients or conveniences, by which to secure certain important public benefits. Patents are of this character. They are nothing more nor less than special monopolies, granted, not because any man has a natural right to them, but simply as expedients to tempt men to study out and develope inventions, which the whole people may be free to use and enjoy. In this way the progress of the useful arts is encouraged, new productions, new industries, and new sources of wealth are created; and the public advantages therefrom derived are supposed to counterbalance the evil effects of those temporary infringements of liberty which we call patents. The practical result of the issue of patents in this country has been, and still is, to promote the material and moral progress of the nation to a wonderful degree. This fact is recognized by everybody, and there is not a corporal's guard on this side the Atlantic who would wish to have the patent laws abolished.

The remaining resolutions of the London agents are, for the most part, sensible and practical. The fifth resolution is especially appropriate to the state of things here, and the reforms which it contemplates, we think, might be applied to our own patent system as well as to that of England, with great success and advantage.

VENTILATION OF THE NEW YORK STATE LUNATIC ASYLUM.

It was our good fortune recently to inspect the admirable system of heating and ventilation in use at the above celebrated institution at Utica, N. Y. The accomplished superintendent, Dr. John P. Gray, has given the subjects of warming and ventilating large buildings a great deal of careful study which, added to observations made during a long experience in the asylum, have resulted in the adoption of a model method. We have visited a great many hospitals, almshouses, and other institutions in which large numbers of people are constantly gathered together, but we do not hesitate to say that we have never entered a more perfectly ventilated building, large or small, than the Utica asylum.

In the course of a long perambulation through the various wards, under the gentlemanly guidance of Dr. Judson B. Andrews, second assistant physician, we met with none of that peculiar hospital smell almost universal in institutions of this kind. There was a constant supply of fresh pure air, without sharp drafts anywhere, and though each ward is provided with the usual water closet accommodations, their presence was not indicated by any offensive odor.

In a conversation with Dr. Andrews, we gathered some general facts relative to ventilation which are worthy of careful consideration. The tendency of the time is toward the erection of large buildings for the accommodation of many rather than small ones for the accommodation of few. Hotels of gigantic size, tenement houses for the poor, etc., are annually built of increasing capacity, and it is a lamentable fact that by far the greater part of these buildings are better calculated to collect and retain the emanations of the kitchen, laundry, and water closet, than to speedily discharge them and supply their place by pure, well tempered, health giving air.

The experience of Dr. Gray in his attempts to perfect the ventilation of the Utica asylum, points clearly to the fundamental fact that no very large building can be ventilated with currents of air produced by heat alone. Artificial currents produced by mechanical power must be employed. The means used in this institution are a large and powerful fan wheel, driven by a fine Corliss steam engine. By its constant action every nook and corner of the vast building was kept in a delightful state of coolness on the day of our visit, though the thermometer indicated 80° Fah. in the shade. A large volume of air was constantly flowing through the various wards, yet there was no perceptible current.

Another fact elicited was that a perfect system of ventilation requires each room or ward to be independently supplied with air, which, after having remained sufficiently long in the apartment, must find independent egress. If two wards be coupled, it will be impossible to regulate the supply of air or warmth so as to make it uniform in each. One or the other will get more or less than its share. Those conversant with the difficulty in maintaining uniform pressure in a complicated system of steam or air pipes will be at no loss to assign a reason for this.

It has also been found that the conveyance of vitiated air from various passages out through a common exit flue, or the smoke stack of the heating apparatus, will not do in any extended system of ventilation. A diffused entrance and a diffused exit must be provided for in order to avoid sharp currents.

To describe the details by which the observance of these general principles has been attained in so effective a manner, under the supervision of Dr. Gray, would lengthen this article beyond its prescribed limits; we may perhaps do this in a future article. Those who are interested in the ventilation of very large buildings would find themselves rewarded by a visit to and a personal inspection of this institution which in its sanitary appliances must be, in every point of view, regarded as a model.

FOLLY AND IGNORANCE---FOLLOWED BY DEATH AND DESTRUCTION.

Many centuries ago, Solomon the wise penned his proverbs, denouncing ignorance and extolling wisdom. Yet could he in the flesh to-day visit this glorious land of liberty, he would be able to look upon as choice a crop of fools as ever were reared in his day, and would sadly retire to the spirit land, more impressed than ever that "all is vanity," including his efforts to induce the human race to make wisdom their first and only choice.

There lies before us a letter from a Water Valley (Miss.) correspondent, describing a destructive boiler explosion occurring under circumstances of such conspicuous foolhardiness as to render it worthy of record.

Four men were employed about the boiler, all of whom were instantly killed. The proprietor escaped, and to-day lives as an illustration of the old saw, that the choicest flowers are culled first. If destruction be the just penalty of wilful folly, surely the continued existence of this man is an example of the mysterious ways of Providence.

His story of the explosion is, according to our correspondent, as follows:

The day previous to the explosion the safety valve was leaking. Instead of grinding down the valve, he placed a piece of gum packing under it. This blew out. A new piece was put under, and then a brace was placed between the valve lever and the roof of the building to hold it down and retain the packing. Having thus got things well in train for a first class blow up, he got up steam, running the pressure up to 105 lbs. "*the last time he looked at the gage.*" He *thinks* there were two gages of water, but is not sure, as *two men* were pumping in water at the time of the catastrophe. That two men were required to work the pump shows that this was out of order. In short, there was no one about the establishment that seemed to know much about anything, more especially steam, and, as a consequence, destruction swiftly followed their silly tinkering.

How long will it be ere people learn that steam is a thing not to be played with? The dangers to which many are exposed by ignorance in the use of boilers and engines are positively frightful.

If a party of reckless ignoramuses should sport with nitro-glycerin in a thickly populated locality, they would be indicted. Why not make it penal for men who know nothing of steam to assume its management? We wish it were so everywhere, and the sooner the better.

LIGHTNING RODS.

In our paper for July 1, we gave an article on lightning rods, showing the proper sizes, arrangements, and earth connections, necessary for the complete protection of buildings from the disruptive effects of electrical discharges.

In that article it was shown that the grand defect of nearly all lightning rods, as commonly put up, is the lack of proper communication between the rod and the earth.

A building is undoubtedly safer without any lightning rod, than it is if the rod be not properly connected with the ground.

Mr. David Brooks, well known as the originator of the paraffin telegraph insulators, and a careful student of electricity, has lately published some useful observations concerning lightning rods, from which we gather the following:

When a cloud passes over the earth it becomes charged with electricity, and the earth directly beneath the cloud is charged with the opposite electricity; but discharge or lightning depends upon the amount of electricity accumulated, the tension of this accumulation, and the proximity of this cloud to the earth.

The cloud is sometimes charged positively, sometimes negatively, but whatever the amount of this electricity, an equal amount of the opposite electricity is accumulated in the earth or some neighboring cloud, or the opposite electricity may be divided or distributed among other clouds and the earth.

The quantity and tension of a thunderbolt is of such immense degree, that unless an adequate channel or path is provided as a conductor, disastrous results are likely to ensue.

The effect of placing an iron conductor or rod between the earth and the cloud, is to facilitate the discharge of the electricity from the cloud to the earth. If the cloud be charged with positive electricity, the rod becomes polarized—that is, if the cloud be charged with positive electricity, the upper end of the rod is charged with negative, the bottom portion with positive, the opposite of the earth, which is negative.

The ordinary rods extend into the earth, but the connection is so poor electrically—that is, the connection has so small conducting capacity—that accumulation of electricity takes place, and violent discharge to any other neighboring object or conductor (as for example, to the building to which the rod is attached) is the result, to very nearly the extent, as if the rod were not touching the earth.

The only method of obviating this difficulty is to enlarge the metallic surface of the rod where it comes in contact with the earth far more than is ordinarily practiced.

All objects conduct, but in vastly different degrees. For instance, iron conducts only about one sixth as much or as well as copper. It has but one sixth the conducting capacity.

They conduct directly in proportion to their sectional area, and inversely in proportion to their length.

A bar of copper, that has one square inch section, a foot in length, has the same conducting capacity as a bar of iron of six square inches section and a foot in length.

The conducting power of iron is fully one thousand million times greater than water. The ratio of difference is less in proportion as the water contains impurities; but if the moisture in the earth were sulphuric acid and water, in the proportion of one of water to eleven of acid, the best conducting liquid known, the ratio of conductivity of this solution, compared to iron, would be, by the determination of Dr. Matthiessen, as one to one hundred and sixty-six thousand; so that, making all due allowance for the impurity of the moisture on account of the acids and alkalies contained, the ground terminal of the rod should expose a surface in damp earth at least equal to the surface of earth over which the building stands.

ELECTROMAGNETIC MOTORS.

Almost coincident with the discovery of electromagnetism, the idea of its becoming a great propeller of machinery became a favorite dream of science. As its laws became more fully known, and the doctrine of the correlation of forces became established, this dream gradually faded from the minds of all but the visionary. Assuming the teachings of science to be correct, it was seen that until some far cheaper method of generating electric currents should be discovered, this force could not compete with steam in economy. The practicability of its employment, even for motors of limited power, has hitherto hinged upon the question of cost, and so far no successful electro-motor has been offered to the public, that could be economically applied to the propulsion of even a sewing machine.

Mr. Paine, whose statements are denied on scientific grounds by many, but backed by others who profess to have experimented and proved them true, asserts that science has hitherto been wholly at fault regarding this matter, and will shortly be obliged to revise its theories and correct them to square with facts he has discovered.

He maintains that the battery is not the source of magnetic power in electromagnets, but is simply a directing agent or indirect cause of the power developed in such magnets. That like the great store of heat in the universe, the stock of magnetism is a constant, and that all we can do with either is to transfer it, or rather to set in play a chain of causes which cause it to become manifest to our senses, and to perform work by its conversion into mass motion. That we have been and are skeptical in regard to these statements, we need not tell our readers, and we shall remain so till we have something more than strong assertions of results attained to convince us. That we, in common with many others, take this ground should neither surprise Mr. Paine nor his friends. They have no right to expect that thoughtful men will accept their assertions as scientific truth without other evidence. Those who say that they have repeated his experiments with like results have a right to believe, but the details of these experiments have never yet been set forth before the world, and we have, therefore, no means of judging whether right or wrong inferences are being drawn from them. That the stories told of marvellous results are deliberate fabrications we do not believe, but then we can say that much of many other marvellous stories which even Mr. Paine and his disciples would possibly discredit, though attested by men who will not deliberately falsify.

But whether Mr. Paine is self deceived or has really made some great discoveries which will revolutionize electric science, one thing is certain, the subject of electromagnetism as a motive force is now undergoing a more severe scrutiny than it has received for many years. The recitation and attestation of the extraordinary claims made by this gentleman have set people to inquiring and studying, and, as a result there probably never was so great activity in invention relating to all sorts of electric apparatus and machinery as exists at the present time. Applications for patents in this field are numerous, and will doubtless continue so for some time to come.

SCIENTIFIC INTELLIGENCE.

A NEW FLUORIDE FROM GREENLAND.

Professor Brush, of New Haven, has discovered a new mineral, associated with cryolite, from Greenland, to which he proposes to give the name *ralstonite*. The mineral is colorless or white, with a vitreous luster, and is harder than fluor spar. Not enough of it was obtained to make a quantitative analysis, but it appears to be essentially a hydrous fluoride of aluminum, with probably a small amount of calcium and sodium. The recent development of the Greenland mine has led to the discovery of crystallized cryolite, and of several new fluorides, called thomsenolite, pachnolite, and ralstonite.

OZONE STORED IN SOLUTION.

Among the queries addressed to us by our correspondents is one in reference to the possibility of storing ozone in solution. It would certainly be very convenient for medical and bleaching purposes if it were possible to do so, and we can suggest a path of research by which it may possibly be attained. Schönbein has shown that if an amalgam of zinc be shaken violently with water, binoxide of hydrogen is produced. We here have a compound that in many respects may be substituted for ozone, and is obtained in a very simple manner. If the process were continued for several hours, the water then filtered and the filtrate evaporated over sulphuric acid under the receiver of an air pump, we could probably obtain a concentrated liquid, suitable for the purposes to which the binoxide of hydrogen is now applied. The drift of experiments goes to show that it is better to prepare the ozone at the moment it is wanted. It is too easily destroyed to be stored in anything. For many purposes the permanganate of potash is the best agent to use for the generation of ozone, when required for bleaching. A small quantity of this salt placed in a bath, and a few drops of sulphuric acid added, liberates sufficient ozone to bleach engravings and even paper stock. And it is the nearest approach to the practical application of ozone to the arts of any that we have seen tried. We are aware that Wilde's electromagnetic machine has been used to furnish ozone for refining sugar and sirup; and the constant discharge of the electric spark by aid of the Ruhmkorff coil has been proposed for the same purpose. We adhere, however, to the belief that permanganate of potash will be found to be the best agent, on the whole, for procuring a supply of ozone at the shortest notice.

USES OF MICA.

The use of mica in the United States has attained greater proportions than elsewhere, and the attention of other countries has been directed to it. It is employed as a substitute for metal in the manufacture of shades for lamps. These are prepared of pasteboard and lined with mica. The light is thus reflected downwards, and the thickness of the board prevents the dazzling effect upon the eyes. There are great varieties of shades now made, and as they are very light and easy of transportation, they can be substituted for glass in distant parts of the country. Mica is also used for transparencies, candle protectors, stove and furnace doors, and in spectacles to shield the eyes of workmen exposed to dust, sparks, and splints. It is also used for the adulteration of bronzing powders and pigments, and when ground can be employed as a substitute for some kinds of mineral paints. Sheets of mica are also employed in the chemical lecture room, where the combustion of metals in oxygen gas is to be exhibited. There is no danger of the breakage of the apparatus from the heat, and the light effects are equal to those attained where glass jars are used. Exquisite colored films can be obtained on mica by employing collodion colored with aniline dyes. The pigment is dissolved in ether and alcohol in concentrated form, and added in small quantity to the collodion. The collodion film is rendered more elastic by turpentine, and can be removed from the mica and cut into various ornamental figures to be again pasted upon any object. If the mica be a little rough, the film of collodion will adhere very firmly. In this way, mica colored by aniline can be obtained, of a great variety of shades, and closely resembling the finest glass.

PURIFICATION OF SODA ASH BY OXIDE OF ZINC.

The crude soda ash of commerce is often contaminated by sulphide of sodium, holding sulphide of iron in solution, giving a dirty yellow color to the ash. To remove this impurity, it has been proposed to add freshly precipitated carbonate of zinc and oxide of zinc, by which insoluble sulphide of zinc is precipitated, and carbonate of soda or caustic soda takes its place. In a small way, this will afford a method for rectifying crude material, which is often too dirty for use.

PREPARATION OF PERMANGANATE OF POTASH.

Five hundred pounds of freshly prepared potash lye of 45° B. are mixed with 105 pounds of pure chlorate of potash, and concentrated by evaporation in an iron kettle; and then, under constant stirring, 182 pounds of finely pulverized black oxide of manganese are added, and the heat continued until the whole is fluid. It is then stirred until cold. The granular mass is again heated to redness in small iron kettles until it is half fused, and is then, after cooling, broken up, boiled with water in a large pot, and allowed to settle. The clear liquor is decanted and evaporated to crystallization. In this way, from 180 pounds of oxide of manganese, 98 to 100 pounds of permanganate of potash in beautiful long needles can be obtained.

NEW REACTIONS OF ANHYDROUS SULPHURIC ACID.

Only the salts of the alkali metals have been known, up to the present time, but Schultz-Sellack has succeeded in preparing the corresponding barium and silver compounds. Anhydrous sulphuric acid acts on the sulphites at 212° Fah., liberating sulphurous acid and producing sulphates; hyposulphites are not formed. When the chlorides of the alkali metals are exposed to the long continued action of the vapor of anhydrous sulphuric acid, double salts are formed, from which the anhydrous acid can be afterwards expelled by distillation. The fluorides, iodides, and bromides also absorb anhydrous sulphuric acid with partial decomposition. Anhydrous sulphuric acid reacts on sulphur, producing sulphurous acid; it also unites with iodine.

PATENT PROCEEDINGS IN LONDON.

An interesting law proceeding has lately taken place in London, in which the Bullock Printing Press Company, of Philadelphia, Pa., were defendants, and appear to have come off second best. This press is now extensively used in this country, and is rapidly being introduced in Europe where patents have been secured. We published an engraving of the invention some time ago. It is probably the fastest press in use, as it prints both sides of the sheet at once, drawing the paper from a roll, cutting off and delivering the sheets as fast as printed.

The trial referred to came before his Lordship the Master of the Rolls, last month.

It appeared that the Bullock Company had entered into an agreement with Messrs. Louis Simon & Son, of Nottingham, engineers, the plaintiff in the suit, whereby they had for very valuable considerations, become the sole licensees in England and on the European continent, for making the famous "Bullock" printing machines for the term of fourteen years, from July, 1869. That several thousand pounds had been paid by Messrs. Louis Simon & Son to the Company, in respect of machines sold to the *Daily Telegraph* and another newspaper proprietor in England, and that nothing was now due, under the agreement, from the plaintiffs, to the defendants. That in February last, a certain firm of solicitors, representing themselves to be acting for the Company, without assigning any reason, had given notice to the plaintiffs, repudiating the contract; and that when called upon by the plaintiffs' solicitors for an explanation, and for the grounds of the repudiation, they had declined to give any explanation whatever, but had since issued a circular, in reply to one of the plaintiffs, wherein they informed the public that the Bullock Company were now making arrangements to manufacture and sell their machines in England. The learned counsel characterized the conduct of the defendants as most "impudent," and, after pointing out that the defendants had received large sums of money from the plaintiffs, applied ex-parte for an injunction, there being no person in this country upon whom legal notices could properly be served.

His Lordship, the Master of the Rolls, after perusing the documents handed in, and remarking that the defendants had given the plaintiffs an express agreement for fourteen years, and upon the difficulty of the case, owing to the defendants not being in this country, granted an injunction against the defendants, their agents, licensees (others than the plaintiffs), and servants, until the hearing of the cause, or further order of the Court, from building or selling, and from authorizing or permitting any person or persons other than the plaintiffs, to build or sell in Great Britain or Ireland or on the Continent of Europe, the machines, in the plaintiffs bill mentioned, patented by the said company during the period of fourteen years, from the 20th of July 1869, or the period for which the English and French patents might last, and ordered that notice of his Lordship's order be served on the solicitors of the defendants in this country and America; the plaintiffs ordering to abide by any order as to damages if the Court should thereafter be of opinion that they ought to pay the same. The case was watched with much interest by the reporters and other gentlemen connected with the press.

Only one side of the story is given in these preceedings, as the Bullock Company put in no appearance.

[Special Correspondence of the Scientific American.]

EXTENSION CASES---SMITH'S PLOW PATENT---SLAWSON'S CAR FARE BOX---TEXTILE MANUFACTURES IN INDIA.

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

Application for an extension of Arnton Smith's plow patent was made in 1868, and refused, but a re-examination was authorized by Act of Congress in January last. The only contestant was George Owen, who claims that Smith was not the inventor, and that the invention was surreptitiously obtained; that he agreed to manufacture to Owen's order; and assigned his interest in the extension before the patent expired. The question of priority of invention, as between Owen and Smith, had already been treated by the Office in 1863, and decided in favor of Smith, both by the Board of Examiners and by the Commissioner.

In such cases, in which a re-examination is granted by special Act of Congress, those parties who may have produced and used the invention in the period between the expiration of the patent and the date of the act have the right to continue the use of it.

The invention is one of great value, and consists in the mode of jointing together two plows (for the purpose of plowing out two rows of plants at a time) in such manner that one can move, to a certain extent, independently of the other. Two plows had been united, for the same purpose, before Smith's invention, but the connection was rigid. The Commissioner has not yet rendered a decision.

James B. Slawson's patent for a car fare box is an ingenious and much needed device, and consists of a box with two chambers, one above the other, separated by a tripping platform, the upper chamber having two of its sides made of glass, so that the passenger and driver can see the deposit. By tilting the separating platform, the fare is transferred to the lower chamber, which is locked. By the use of this device a railroad company saves the expense of a conductor, and a conductor's (supposed) stealings. The roads that have adopted the invention are necessarily obliged to find some means of making change, and it is usual to place in a box, accessible to the driver only, a supply of sealed paper packages, each containing one ticket and sufficient change to make it equal to one of the smaller currency issues; that is, a 10 cent, a 15 cent, a 25 cent, or 50 cent package. This arrangement removes the serious difficulty that would otherwise arise, adds but little to the labors of the driver, and causes the passenger, in case he has not in hand the exact fare, no more trouble than passing his currency to the driver through a small opening in the front door, receiving his package in return and depositing the inclosed ticket in the fare box. The extension was granted.

It was claimed by the party opposing the extension (Mr. R. D. O. Smith) that the patent was anticipated by English patents, and ought not to have been granted, but the two reissues must have fully tested this question. Mr. Slawson has received other patents for improvements on his original mechanism, and these are generally adopted.

The following extensions have also been granted: Patent to William M. Welling for a process for manufacturing artificial ivory, white and red, by the use of shellac, ivory dust or its equivalent, and camphor, suitably mixed and heated. This substance can be molded into any shape, and is extensively used for billiard balls, pianoforte keys, etc.

Patent to Isaac Hayden for a bobbin for roving and slubbing. The portion of the barrel of the bobbin which receives the second layer of roving is made larger than that which takes up the first layer, by which a uniform draft is maintained.

Patent to Charles Perley for a compound capstan. The windlass is so constructed that the shaft is constantly relieved of the weight or strain of the cable, and has simply to rotate the windlass when the two are in connection. The capstan can be used with or separate from the windlass, and also as a coupling for rotating it.

Patent to James R. Floyd for a retort cover made of malleable iron, and the patent to G. H. Halskamp for an improved pianoforte string bridge.

INDIAN TEXTILE MANUFACTURES.

It too often happens that scientific men, educated inventors, and manufacturers visit Washington without giving the library of the Patent Office the examination it merits. In

works on general science, and especially in those pertaining to all branches of technology, it hardly has its equal in the country, not only in the standard works, the classics of science, but also in the current, of England, France, and Germany. The foreign and American scientific journals alone form a collection of the greatest interest and value to those actively engaged in the practical arts. It is a feature of the present management of the library, as conducted by the learned and very obliging Librarian, Professor G. C. Schaeffer, that all the latest reliable works on the arts and customs of all countries, as already developed, and as developing under the influence of modern science, are procured. It is wholesome for the Anglo-Saxon that his conceit should occasionally get a sharp rap from the outside barbarians, hinting that possibly all wisdom and virtue will not die with him, and that even crude and Pagan notions can contribute something of value to the race.

Among the works recently added to the library is one issued by the English Government, containing much valuable matter, and illustrating the diligence of that country in strengthening its manufacturing interests as connected with its Eastern possessions. It is an official report, by Mr. J. Forbes Watson, to the Secretary of State for India, on the textile products of that country, the object being to furnish to the British manufacturers and merchants the fullest and most exact information in regard to these products, first, as a guide to the importer in filling his orders, and secondly, and of vastly more importance, as indicating the needs and tastes of the people of India, it being the policy of the Englishman to make his looms weave fabrics for the beloved East Indiaman as nearly as possible similar in quality and color to those worn and produced there for so many centuries.

And what do we find that the pagan Hindoo can accomplish with his needle and his rude hand loom and distaff? In the India Museum are collected samples of nearly 1,000 varieties of these fabrics, of which 700 have been selected and arranged in 18 large volumes, each accompanied with a full description, sufficient to enable the manufacturer to reproduce the article, if within the range of his power loom. Twenty sets of the 18 volumes each have been collected, and placed in the leading manufacturing cities of England for the inspection of those immediately interested, or rather 13 have been so deposited in England, and the remaining 7 at Calcutta, Bombay, and other cities of India.

The report of Mr. Watson, above alluded to, contains a description of each of the above specimens, together with many fine colored photographs of East Indian fabrics and costumes.

Let me add, in brief, a few items of general interest gathered from this volume.

In early times, before the invasion of India by the Mahometans, cut and sewed garments were unknown, all articles of apparel, including the head dress, being worn as coming from the loom, usually in the form of a sash, the width, length, and arrangement depending on its use, whether as a covering for the limbs, or the body, or as a turban for the head. The prejudice against sewed garments is by no means removed, and to many Hindoos of the present day they are an abomination as vile as liquor drinking and drunkenness. Among the Hindoo women, the petticoat is not yet considered a legitimate garment, and ladies of rank who have adopted it lay it aside when they eat, cook, or pray. There was a period when India largely supplied England with textile fabrics, among which were the famous "long cloths," as they were called, and also calicoes, the word derived from Calicut, a town on the Malabar coast; but in shawls, carpets, and embroideries, England cannot compete with the East. The Dacca muslins also still remain unequalled for fineness and durability. At the London Exhibition in 1862, a few yards of English muslin were shown, woven from a thread ·00216 of an inch in diameter, but the finest Dacca thread is only one quarter the size; and there is this essential difference, that the finest European muslins have little or no durability, whereas the Dacca muslins, of far finer quality, are strong and lasting. This is in part explained by the fact that the thread of the India fabric, being made by hand, is more closely twisted and compressed, the number of twists to an inch in the best English being 68·8, the Indian 110·1. Will some inventor take note that the above figures seem to call for an improvement in spinning machinery? It is also said that the greater thickness of the fiber of Indian cotton may, in some manner, account for the difference.

One pound of the finest Dacca thread is 250 miles in length. The most delicate pieces are transported in bamboo reeds, and a tube eighteen inches long and one inch in diameter, will hold twenty-two square yards. A Persian ambassador to India, on his return to his native country, once presented the king with a cocoa nut shell, containing a turban sash sixty cubits long. The warp threads, in the best qualities, number from 1,000 to 1,800 in a piece one yard wide. Four square yards of some specimens weigh only 566 grains. The Emperor Aurungzebe reproved his daughter because, on a certain court occasion, the outline of her form could be distinctly seen through her dress. Her maidenly defense was that her covering consisted of seven garments.

The Hindoo's loom has a yarn beam, a cloth beam, heddle, swinging lathe, shuttle with an eye, treddles, and temple.

The Cashmere shawls are of two kinds—one made by weaving small pieces and sewing them together; the other by embroidering the pattern on a plain woven cloth. The real Cashmere thread is called *pashumeea*, and is made from the down, not the hair of the Thibet goat, which is raised in several of the most mountainous provinces of that country; but the wool or down is all carried to Cashmere for manufacture, the business being under the strictest Government control, and to such a degree that no real *pashumeea* wool can be sold or smuggled into any other province of India.

Fine shawls are made in the Punjaub and other provinces from goats' and sheeps' wool, and sold as genuine Cashmere, but are an inferior article. In Cashmere 100,000 persons are employed in the shawl manufacture. The weavers are all males, most of the spinners women. A female spinner earns about 75 cents a month. The weaving of a shawl of ordinary pattern occupies three weavers for three months, the more elaborate and costly for from twelve to fifteen months.

CANCER CURE.

If, as is claimed, the plant called "cundurango" is a specific for cancer, the world has received a blessing in the discovery which will rank with the introduction of anæsthesia in surgery. Where there is such room for skepticism, we may be pardoned some doubts that the new remedy is all that is claimed. If it be, however, the powerful specific alleged, it will outlive our doubts, and establish itself triumphantly. In a disease so hopeless, people will catch even at the shadows of hope, and so the new remedy will be sure to have ample trial.

The story is that an Indian woman in a province of Ecquador, attempting to poison her husband by the use of this plant, cured him of a cancer of long standing. This fact having become known to the American Consul, he obtained a sample of the plant and forwarded it to Washington to have its virtues tested. It is further said that about fifteen cases have been successfully treated with it, and that a large supply is on its way to this country. Without pretending to vouch for the truth of the above, we will say that St. Paul's advice, to prove all things and hold fast that which is good, if followed, will soon settle the merits, or want of merit, of the new cancer cure.

Vice President Colfax states that his mother, who was at the point of death with cancer, has been restored by the use of cundurango, and is now nearly well,.

The patentee of this new medicine, is Francis Baker, No. 120 Broadway, N. Y.

Steam Power on Canals.---A Scotch Device.

An esteemed correspondent sends us a description of a tow boat, used on the Forth and Clyde canal, Scotland, in the year 1847 and subsequently. The boat, built by William Napier, of Glasgow, under the superintendence of William Parlane, an engineer well known in the same locality, was about twenty-five feet long and twelve or fifteen feet in the beam. She had two propellers, forward under the bow, and a double round bottom or keel. The propellers were right and left respectively, and so threw the water towards the center, the water passing out of the stern by a passage made for the purpose. A rudder was dispensed with, the steering being accomplished by varying the relative speed of the propellers, which were driven by independent vertical engines. This arrangement was so effective that the engines, moving in different directions, would turn the vessel on its center, or, as we say, in its own length. On a test, the boat parted a hemp cable of two inches diameter without headway. This, our correspondent states, is equivalent to a seven tun strain. The vessel, named the *Puddock* (*Anglice* "Frog"), towed regularly ten or fifteen deeply laden scows, at a rate varying from three to five miles per hour, with only a man and a boy to the whole train of boats. No difficulty was found in turning sharp curves.

Our informant questioned Mr. Parlane as to the most important point of the wash caused by the boat, and received from him an answer to the effect that she could be driven at seven miles an hour without any damage to the banks; but the scows of course would create a wash, varying with their shapes and sizes, as they do with horses or other means of propulsion. The Forth and Clyde Canal fell into the hands of a railroad company which now runs large propellers thereon; but whether the *Puddock* is still in existence is unknown to our correspondent.

Bessemer Cast Steel.

Mr. Bessemer has taken out in this country five patents for new processes in the treatment of iron and steel, construction of furnaces, etc. Of these, the most important novelty, and the one which will add most to Mr. Bessemer's renown as an originator, is the subjecting molten iron to atmospheric air at a pressure by which sufficient heat is maintained to keep the metal in perfect fluidity until it is poured into molds. This intense heat is kept up by the aerostatic pressure in the converter, which obviously continues a large supply of oxygen to the molten metal. A converter of great strength is provided for this special purpose, the mouth being made smaller than usual and lined with a ring of well burnt fire clay, or a composition of clay and plumbago. A pressure of from 15 to 20 lbs. on the square inch is necessary, and will require to be varied with the different kinds of iron.

CORRECTION.—WATER HEATER.—In our notice of a water heater designed for greenhouses, conservatories, etc., printed in our issue of July 1st, the invention was wrongly accredited to John Lynch only, whereas it should have been David Smith and John Lynch, of Boston, Mass.

KEROSENE applied with a cloth to stoves will keep them from rusting during the summer. It is also an excellent material to apply to all iron utensils used about a farm.

TO CLEAN CARPETS.—Salt, sprinkled upon the carpet before sweeping, will make it look bright and clean. This is also a good preventive against moths.

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.

BELTS.—I would say to J. B. L. and his informers, F. E. H. and S. G. D., that the running of a belt to the highest part of a pulley is owing to centrifugal force, which tends to throw the belt from the highest part, or where the diameter and velocity of the pulley is the greatest, and to the change in the line of direction between the driver and driven pulleys.—M. D. C., of Mass. [There is no doubt that centrifugal force plays a part in rapidly revolving pulleys, which tends to throw belts to the highest parts. But belts will run to the highest parts of pulleys when the latter run at speeds so low that practically the centrifugal force is nothing. The explanation of M. D. C. is not adequate. Previous explanations are correct. We shall publish no more at present upon this subject.—EDS.

SPECIFIC GRAVITY OF HYDROGEN.—S. F. asks specific gravity of hydrogen. Air being *one*, it is about .068 or .07, nearly. It would require about 2,100 cubic feet to sustain a weight of 140 lbs. A balloon thirteen feet in diameter, spherical in shape, would contain about that amount.—A. G.

LESSENING STRENGTH OF PAPER.—I think that C. C. will find, as I did, that sulphuric acid will serve the purpose best According to the thinness of the paper operated on, indigo should be added, as it diminishes the strength of the acid, gives color to the lines, rules smoother, and dries quicker. Use a gold or glass pen.—This is in answer to C. C., in SCIENTIFIC AMERICAN of July 15, 1871.—W. E. B.

SMOKE STACK.—I am running a 24 H. P. engine, driving a 12-stamp quartz mill. The mill is located so high up in the mountains that when the wind blows in a certain direction, I have little or no draft; would I have better draft by exhausting in the smoke stack?—J. A. L. ANSWER.—Yes, but if you have draft enough when the wind is in some quarters, you can probably secure the desired result by placing a revolving vaned hood on the top of the smoke stack, so that its closed end shall always turn to the quarter from which the wind is blowing.—EDS.

BORING CYLINDER.—In number 4, vol. XXV, G. S. R. wants to know why he cannot bore as fast as he can turn. Very few machinists make as good inside as outside work. It has been done, and is being done regularly in one shop, at least. The difference in the amount of work done is very slight indeed, if any at all, when proper tools are used. B. P. G.'s would by no means answer the purpose. There is no good reason why a 24 inch engine lathe will not bore a cylinder as large as can be got upon it, taking out as much as a half inch in diameter, if need be, the tool point moving at the rate of 20 feet per minute, with .2 inch feed. It is quite probable that G. S. R. would be convinced only by actual demonstration. He gives his cut as 1-16th, but does not say what his feed was. The fore-mentioned feed, .2 inches, is for first time through. Finish may be five times as much, 1 inch, certainly not less than 2½ times as much, or .5 inches. Only think of 83 turns to the inch! with ¼th inch cut only! in good cast iron, and making not over 13 feet speed, week in and week out, too. In cutting tools there is needed the most thorough reform. A planer or lathe tool with nose an inch square to grind off, ought to be a thing of the past, though it is not, having seen several scraping away the past week.—A. M. S., of Mass.

BELTS.—I reply to J. E. G., volume XXV, number 4, query 10; the belt will incline to the lower end.—B. C., of N. H.

BELTS.—J. F. M. Always run your belts on the side they are made to run on, that is the head side of the rivet, but buy your belts to run on the hair side. I have had great experience in that line, I have often seen belts that would not pull on the flesh side, and I would turn them over and they would run with no trouble whatever. If you require a great strain on your belts, take some pulverized rosin and dampen it with a little oil. Set it on your boiler until the rosin is entirely melted, then put in a cool place until it sets. Use very little at a time; it will give you three times the power, preserve your belts and cost but a trifle.—G. A. Y.

RELATIVE POWER IN TURNING AND BORING.—G. S. R. I think the answer to this query is very simple to anyone that handles a lathe. Any machinist knows he can't bore as fast as he can turn, and that it takes more power to bore than turn. Although it is a difficult task for me to explain to G. S. R., I will do my best by simply stating, that in turning the tool acts on the circle like a cutter or a wedge; and in boring the circle is so that the tool backs the metal, and the cut is more of a break. He may use any tool he likes, and he can't bore with the same power and speed that he can turn with. If G. S. R. will fasten his dog or catch on the boring bar as much as possible under the leverage of his lathe pulleys he will gain all the power required.—G. A. Y.

TURBINES.—In number 26, volume XXIV, J. W. C. wants information about turbines. They no doubt act precisely the same when used at their full capacity, whether the gate is at the bottom of the wheel or at any other point, provided the opening is a proper one. They certainly are no more a reaction wheel on that account. I know of no thorough series of experiments to determine the efficiency at partial gate arranged in that way. Enough is, however, known to place a half dozen other arrangements very much above it.—A. M. S., of Mass.

SPEED OF SURFACE IN TURNING CAST IRON.—A. H. G., in number 25, vol. XXIV, asks for the proper speed of surface in turning unannealed cast iron, amongst several other metals. In one shop, where the writer is acquainted, the speed has been often observed below 8 feet per minute, rarely as high as 15 feet. In another, rarely below 18 feet, and he has observed fully 40 feet per minute, often 22 to 25 feet per minute. He considers 20 feet a fair average for cast, and 18 feet per minute for wrought iron. Very much, however, depends upon the style of tool used.—A. M. S. of Mass.

ELECTROTYPING ON WOOD.—Has H. W. L. tried coating the wood with copal varnish, and then blackleading it?—D. B., of N. Y.

COATING GLASS WITH METAL.—C. E. G. should make a varnish of two parts asphaltum and one part mastic, by melting together, and when cool, adding sufficient spirit of turpentine to make the compound of a sirupy consistence. Before applying the varnish, roughen the surface of the glass with the fumes of hydrofluoric acid. Deposit a good thick coating of metal on the varnish.—D. B., of N. Y.

TABLE CUTLERY.—R. S. S. H.'s difficulty is that his knives are made to sell, and not to cut with. Cutlery made by a trustworthy firm will not lose its edge easily, or become worthless when it does.—D. B., of N. Y.

POLISHING MEERSCHAUM.—A. R. will find meerschaum dust to be the best thing for this purpose.—D. B., of N. Y.

BELTS.—J. F. M. will find that his belts have more hold if he puts the flesh side next the pulleys.—D. B., of N. Y.

POUNDING PISTON.—You may depend upon it that if that piston does not knock anywhere, that the trouble is in the valve. It is leaking sufficient to make a lead, and thereby wrenches the engine on the centers. Cut off your lead entirely and let us know the effect.—G. A. Y.

CLEANING GUNS.—Seeing a query "how to clean guns or fire arms of any kind," I would say to all who have access to an engine, take the nipple or breech pin out, (or leave both in if the gun is not too foul), and put the muzzle to a cylinder cock, or a pet cock, and send a jet of steam through it. No one who has this opportunity can find anything better.—J. A. M.

FIXING PENCIL MARKS.—Lizzie and G. G. R. send directions for *varnishing* the paper, which is not what J. H. R. wants. The milk treatment is the best, as it does not affect the surface of the paper at all. D. B., of N. Y.

TO PREVENT LEAKAGE OF OIL BARRELS.—L. & B. In case any of my oil barrels leak through the seams, I simply use a glue size, painting the barrel well with it. I use a cheap comminuted glue.—G. A. Y.

HARDENING BRASS.—Annealed brass cannot be hardened, without hammering or rolling it.—H. J.

CULINARY UTENSILS.—Use block tin or heavy copper kettles well tinned, and when the tin is worn off, the kettle can be tinned over again at very small expense.—H. J.

J. S. T. asks: "Has a cannon ball ever been fired from Dover to Calais?" He writes:—I assert that it has not, but my opponents, "who will only take the decision of your paper as final," base their argument on the existence of a certain gun at Dover Castle with an inscription to this effect upon its breech." "Grease me well, and keep me clean, and I'll throw you a ball to Calais Green!" ANSWER.—The gun alluded to is evidently more mendacious than pugnacious. It seems almost silly to answer "no" to such a query, but we do it to oblige our correspondent, who evidently asks in good faith.—EDS.

J. B., of La.—There are many ways of carrying weights, suspended on wires, past the supports which sustain the wires. None of them can well be described without diagrams. Your second query is too indefinite.

C. E. M.—If you cannot understand that your method of getting the area of a circle is only theoretically approximate, nothing we can say further will convince you.

H. C. P.—Your statement is worthless as given. Show some proof that the answer to B. A. J. is wrong, if you wish attention.

A. M. W., of N. Y.—Your boiler, judging from the specimen of scale sent us, acts a concentrator of the dye stuffs held in solution by the stream which flows from the dye-works above. We see no practical remedy for the trouble, unless you can obtain your water from some other source, or can use a surface condenser.

R. F. H., of N. Y.—To run at the same speed up a river as down, a steamer's paddle wheels must of course make enough more revolutions to compensate for the velocity of the stream.

Examples for the Ladies.

Mattie E. Duncan, Shelbyville, Mo., has, in eleven years, made with her Wheeler & Wilson Machine about 2,500 heavy dresses, coats, overcoats, shirts, and pantaloons, and paid nothing for repairs. The machine is still in perfect order, and she has half of the original dozen of needles.

Among the doctors who take their own medicine may be counted the Advertising Agents, Geo. P. Rowell & Co., of No. 40 Park Row, New York. They are themselves among the largest advertisers in the country, and know, by experience, when and how to advertise.

Washington Irving, a great sufferer from Asthma, found relief in Whitcomb's Remedy.

Business and Personal.

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The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 10c. a line.

For best Lubricating Oil, Chard & Howe, 134 Maiden Lane, N.Y.

Copper and Brass Seamless Tubes (from 3-8 to 5 in. outside diameter. Merchant & Co., 507 Market st., Philadelphia.

The Eccentric Elliptic Geared Power Presses are the best in the world. For Circulars, address Ivens & Brooke, Trenton, N.J.

The No. 9 Bucket Plunger Pump we have works to our satisfaction. Ironton, Pa., R.R. Co.; made at Easthampton, Mass., by V. M. Co.

$50,000 can be made from Abbe's Patent Bolt Forging Machine in a short time. Best designed in United States. Investigate. Patent for sale. Address John R. Abbe, 119 John st., Providence, R.I.

The Baxter Steam Engine will not explode.

To Cotton Pressers, Storage Men, and Freighters.—35-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 75 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water st. New York.

We think the Bucket Plunger Steam Pump, made at Easthampton, Mass., the best in the market. J. Hunter & Son, N. Adams, Mass.

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

Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth st., Brooklyn, manufacture Presses and Dies. Send for Catalogue.

The Bucket-Plunger Steam Pump discharges at both strokes, with only two water valves. Valley Machine Co., Easthampton, Mass.

Lord's Boiler Powder is only 15 cts. per pound by the bbl., and guaranteed to remove any scale that forms in steam boilers. Our Circular, with terms and references, will satisfy all. Geo. W. Lord, 107 W. Girard ave., Philadelphia, Pa.

The Baxter Steam Engine pays no extra insurance.

Steam Watch Case Manufactory, J. C. Dueber, Cincinnati, Ohio. Every style of case on hand, and made to special order.

We have two Bucket Plunger Steam Pumps working to our entire satisfaction. Williston Mills, Easthampton, Mass.

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For Hydraulic Jacks, Punches, or Presses, write for circular to E. Lyon, 470 Grand st., New York.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

Copper and Brass Seamless Tubes (from 3-8 to 5 in. outside diameter). Merchant & Co., 507 Market st., Philadelphia.

Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

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A first class pattern maker wanted, one capable of designing preferred. Moderate wages, but steady employment. Address Exeter Machine Works, Exeter, N. H.

Wanted—A thoroughly competent and practical draftsman None others need apply. American preferred. The Watson Manufacturing Co., Paterson, N. J., opposite Depot.

The No. 2 Bucket Plunger Pump we have in our Mill never gives us any trouble. J. Keating, Portland street, Boston.

Want—2d ☞ 2 H.P. Roper Caloric. "Inventor," Lincoln, Ill.

For Sale—A complete set of Patent Office Reports. Price, $150. Government books supplied. Address A. Hunter, Bookseller, Washington, D.C.

Send descriptive circular of Sectional Boilers, and lowest cash price, to William B. Collier, Bridgton, St. Louis Co., Missouri.

The Baxter Steam Engine Co., 18 Park Place, New York, have the most economical engine. Sizes 2 to 10 H.P. Send for Circular.

Wanted—A small Gas Holder, about 6 ft. x 6 ft., and tank, in good condition. Address J. M. Crafts, Lenox, Mass.

Quinn's Patent Ferrule makes good all leaky boiler tubes. Address P. Quinn, South Newmarket, N. H.

Self-testing Steam Gauge.—The accuracy of this gauge can be tested without removing it from its connection with the boiler. Send circular. E. H. Ashcroft, Boston, Mass.

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Send your orders to J. Dane, Jr., Newark, N. J., for Lathes, Presses, all kinds machinery and models, improved jewelers' rolls, etc.

See advertisement of new Machinist's tool on last page.

d'Heureuse's Patent Air Treatment in the quick, cheap, and perfect manufacture of wine, cider, spirits, sugar, oils, etc. Rights for sale. For particulars, apply to R. d'Heureuse, P.O. Box 6,344 New York.

Sell your patents for the Pacific coast through Wiester & Co., 17 New Montgomery street, San Francisco, Cal.

The Baxter Steam Engine is made like the Waltham Watch, each part duplicated.

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

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

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

The Baxter Steam Engine is "the perfection of motive power."

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

Power Punching and Shearing Machines.
For car builders, smith shops, rail mills, boiler makers, etc. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

We are perfectly satisfied with our No. 3 Bucket Plunger Steam Pump. Nashawannuck M'f'g Co., Easthampton, Mass.

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

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

The Baxter Steam Engine is manufactured by Colt's Arms Co., Hartford, Ct., and sold by the B. S. E. Co., 18 Park Place, New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.

Queries.

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

1.—VARNISH.—What kind of varnish can I use for covering polished iron, something that will adhere and become hard? I have used shellac, but it does not answer the purpose.—J. H. W.

2.—SOAP MADE WITH SALT.—Can you, through your paper give me a recipe for making soap, as mentioned by Mr. Alex. S. Macrae, of Liverpool, England, on page 18, current volume?—C. F. M.

3.—FORCING WATER THROUGH IRON.—Is it possible, in testing a cylinder by hydraulic pressure, to force water through the iron so as to make it look like mist? Or is it more probable the water would be forced through the connecting joint to produce the same result?—J. C. C.

4.—FORCE OF GUNPOWDER EXPLOSION.—What power is gunpowder capable of exerting? and how is it ascertained? What are the obstacles in the way of using gunpowder as a motive power? How many pounds pressure to the square inch does it exert when exploded? Can the amount of pressure be regulated by reducing or increasing the amount of powder used? What other similar compounds are there to be used instead of gunpowder that would not leave so much dirt or residuum when ignited?—N. D. W.

[If N. D. W. will turn to page 297, last volume, he will find nearly all the information he seeks.—EDS.

5.—SMOKE CONSUMING.—I am annoyed by the smoke from a steam mill, near by, where shavings are used for fuel. Is there any method by which the smoke can be consumed? The proprietors are willing to bear the expense if it can be done. Their engine has a good draft, and there is a chimney about sixty feet high. The mill stands below me, but the smoke settles all about me. Is there any relief? If you can suggest anything, it would be a great favor.—J. F. M.

6.—CLOTH IMPERVIOUS TO SOAP AND WATER.—I wish a kind of cloth which will stand the action of soap and hot water without rotting, and which will not require cleaning, after use, to keep from decaying. The cloth should be thin and very pliable. Or can I saturate linen or silk with a solution to prevent the action of the soap and water? If so, with what?—H. L. P.

7.—WATERPROOF COVERING.—I want something that is fire and waterproof to cover the deck of my steamboat. I think I saw something advertised in your paper, felt or prepared cloth or paper, said to be adapted to such purposes.—C. M. S.

8.—OLD BOOTS AND SHOES.—To what purpose and where can old worn out boots and shoes be used?—L. S.

9.—JAPANNING ZINC.—I wish to know what will make japan (baked) stick on zinc or spelter.—E. M. D.

10.—OZONE.—Will some one inform me if ozone can be procured by heating the vapor of ether in a vacuum, or without the presence of oxygen?—C. E. S.

11.—GREASE SPOTS.—Please inform me what will remove grease spots from paper on the walls of a room without disfiguring or injuring the paper.—M. D. C.

12.—TELESCOPE.—Will some astronomical reader give directions, dimensions, etc., for constructing a telescope, the body to be square and made of wood? Please give diameter of lenses, distance apart, etc. I require it for the study of astronomy.—M. L. B.

13.—RETORT.—I have some steam heating retorts, worked under high pressure, and it is necessary to open and close them many times in a day. The doors or bonnets should have been recessed for gaskets, but are not. The gaskets bother me. What is the best thing to make them stick?—C.

14.—DECAYING OR SOFTENING GUMS.—Can some of your readers inform me what to do to harden my gums? The points of the gums between the teeth are detached, and the gums are inflamed. I have always used a brush after meals to keep my teeth clean.—W. W. G.

15.—FRACTURE OF IRON.—I have a gasometer supported by 8 iron columns 14 feet high, 12¼ inches diameter. They have been in position and doing duty fourteen years. Lately four of them have cracked, the crack showing itself about the center of each, and running lengthwise in the column. Each crack is from three to four feet long. They are hollow, so that no water could fill in and freeze. Can you or your readers tell me what causes the column to crack?—W. M. B.

16.—BELTS.—In your issue No. 3, Vol. XXV., S. G. D., of Pa., gives a good reason "why a belt will run to the largest part of a pulley." I ask him or any of your readers why a band saw will not do the same thing?—J. W.

17.—WATER WHEEL POWER.—I have a small stream, affording, on an average, forty square inches of water, with thirty feet head and fall. Is there a water wheel that will run with this amount of water under the given head, and drive one pair four feet stones, and a sixty saw cotton gin at full speed? If so, what wheel?—W. A. W.

Declined.

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

CURE FOR BEDBUGS.—J. L. M.
LUBRICATING OIL.—W. F. N.
ROACHES.—A. W.
SPEED OF CIRCULAR SAW.—J. H. M.
ARTICLES ON CANAL NAVIGATION, by N. L. C.—E. J. F.—T. M. B.—W. C. G.—W. W.—J. G. D.—J. B.—Mechanic.
OZONE GENERATOR.—P. A. R.
APPARATUS FOR DIVIDING POWDERS.—G. P. A.
BOSSES AND MEN.—H. ——

Recent American and Foreign Patents.

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

PRINTING TELEGRAPH.—David Flanery, of New Orleans, La.—This is a new telegraph instrument for printing messages upon strips of paper, which simplifies the electric as well as the mechanical appliances of the apparatus. The devices heretofore in use for the same purpose were generally either too complicated and costly to become generally introduced, or too slender in construction, and therefore easily out of order. The present apparatus requires but one main battery at the terminuses of each circuit or at one terminus, and employs no polarized or permanent magnets which are liable to change. It has but one series of wires, where heretofore two or three were required. It operates without requiring the reversal of the battery and without throwing excessive strain on the same. It consists in a novel arrangement and construction of electro-magnets; in a new arrangement and disposition of the wire which constitutes the circuit; in the application of the apparatus of resistance coils, whereby the course of the current is changed; and in the combination of certain keys for regulating and controlling the currents of electricity, and in a new combination of mechanism, which constitutes the printing machinery and the devices for feeding the paper.

STENCH TRAP.—Samuel Lawrence, of New York City.—This invention is an improved attachment for stench traps, which is constructed to prevent the trap from being drawn dry by the siphon action of the discharge pipe, and thus prevents any foul gas or odor from passing back from the discharge pipe. It consists in a combination of a valve attachment with the discharge pipe leading from the stench trap.

SHINGLE MACHINE.—Oliver A. Olmsted, of Sebastopol, Cal.—In this machine shingles are split from bolts, shaved, and jointed. The block or "bolt" from which the shingle is to be cut is placed in a recess on the carriage. The revolution of a wheel carries the carriage by means of a pitman. As the splitting knife is forced forward, it splits a shingle from the bolt, which shingle is guided by a spring on to a lower stationary bed. As the carriage returns, the butt end of the shingle is forced between stationary shaving knives, which are attached to and supported by the rods on each of the ends of the knives. As the carriage is drawn back for shaving the shingle, the knives are gradually forced toward each other by the carriage, which gives the taper to the shingle. The shingle, when shaved in this manner, drops down with the shaving from the upper side, while the under shaving is conducted down by a curved plate. In being shaved, the shingle passes over a roller, by which it is carried back after it leaves the knives. The bolt is held down by a dog. A knife for jointing the shingle in the bolt works vertically in an upright frame. A shingle is split from a bolt and shaved at each revolution of the driving wheel. The shaving knives are made adjustable by set-screws, so that they will shave the sides of the shingle evenly.

FRUIT GATHERER.—George Aldridge, Henderson, Ky.—A stand or table is used, resting upon legs, with a pivot bar passing through it, which bar is adjustable as to hight, and turns freely in the table or stand. The bar has a pulley in its top, on which the picking staff rests. A weight is attached to a cord, which cord is attached to the staff, and passes over the pulley. This weight prevents the staff from slipping back when the latter is used at an angle in picking the fruit. The picking jaws are attached to the end of the staff at one end, and pivoted together at their other end. The fruit is conducted down to a basket or other receptacle. A rod extends along the staff, where it is kept in place by small staples, and is attached to a thumb lever. A spring is connected with the rod pivot. When the rod is drawn down by pulling the thumb lever back, the arms of the jaws are drawn together and the jaws are closed. When the thumb lever is released, the spring recoils and draws back the rod and opens the jaws. It is claimed that the picking staff can be operated by means of the stand without fatigue, and may be turned laterally in either direction and adjusted as to hight by altering its angle or by readjusting the bar in the stand, and that by this arrangement the objections to the fruit pickers in use are obviated, as a boy may operate this picker, while it is very fatiguing for a strong man to pick fruit with those hitherto used.

OIL CAN.—This invention, patented by Paris Childs, of Northampton, Mass., is a device for regulating the amount of flow from oil cans. To this end, a threaded wire passes through a stuffing box at the bottom of the can, and reaches up into the interior of the conical nozzle of the can. By turning the wire by means of a milled thumb-nut, the wire is thrust upward or drawn downward, thus reducing or enlarging the area in the nozzle through which the oil flows.

TREADLE FOR SEWING MACHINES.—A foot piece, rock shaft, and spring, are constructed and arranged together, to enable the ankle joint of the operator to be always held in line with the center of motion of the treadle to save the waste of power in moving the entire lower limb at every vibration of the crank shaft. James W. W. Gordon, of Newport, Ky., is the inventor.

LOCOMOTIVE BOILER.—Samuel J. Hayes and Edward T. Jeffery, of Chicago, Ill.—This invention relates to an improved method of putting in the crown-bars employed in locomotive and other boilers for staying the crown-sheet. The invention is also applicable to stationary or portable or marine boilers when constructed with an inside furnace requiring crown-bars. The improvement consists in extending the crown-bars across the boiler to the outside sheets of the shell, and supporting each end of them on a bar or angle plate bolted or riveted to the shell, and also bolting the shell to the ends of the crown-bar. When necessary, the rods may be used extending across from side to side of the shell above or between the crown-bars.

AUTOMATIC CAR BRAKE.—Joseph R. Crabill, of La Crosse, Ill.—This invention has for its object to furnish an car brake. This is so constructed as to be applied by the running together of the cars as the engine is slowed, whichever end of the car may be forward. The suspension of the brake from supports pivoted directly above the axle of the wheels to which the brake is to be applied, so that the movement of the said supports in either direction will apply the brake to the wheel, is the feature of the invention, while the details of construction are also covered by the patent.

COLLAR PIN.—Joseph McGee, of Lancaster, N. H.—This is a combination of necktie and collar pin, and an improvement in fastening the collar. A neat and saleable invention.

STOVE PIPE DRUM.—Benjamin Webster, of Kingfield, Me.—Within the pipe is suspended a hollow inverted cone, of suitable length, its large upper end being of such size that around it sufficient space is left for the escape of smoke. To the lower end of the cone lead transverse pipes, which communicate with the outer air to conduct air into the cone. Larger pipes extend from the upper part of the cone to and through the sides of the pipe to convey the heated air from the cone to the room. The outer air entering the cone through the first named pipes becomes heated by the products of combustion which surround the cone, and escapes in such heated state through the other pipes. An air circulation is thus provided which does not add to the expense of heating, but greatly augments the effect. Semicircular dampers, arranged with their diametrical pivots close together above the cone, can be used for opening or closing the smoke space.

SAFETY SHAFT FOR VEHICLE.—Jonathan S. Tibbets, Brazil, Ind.—This invention has for its object the construction of shafts for buggies and other vehicles, so that should the horse become frightened or otherwise unmanageable the driver may readily detach him from the vehicle, and, at the some time, in such a way that he will not be liable to injure himself with the parts of the shaft that he carries with him; the shafts, when detached, being supported by suitable straps so that they cannot drop.

SEWING MACHINE TABLE.—John C. Cochran, Ripley, Ohio.—This invention consists in providing the machine covers and the tables with means for readily attaching the covers, when removed to use the machines, to the tables, whereby the capacity of the table is increased, and a place is provided for the cover, when removed, in connection with the machine, where it is always at hand when required for replacing. By this invention the box, which is of no use when the machine is in use, is utilized for a table extension with but a trifling cost, thereby affording the same result that is afforded by the folding tables, heretofore used.

WOOD PAVEMENT.—Blocks placed endwise are employed, sheet metal strips of U shaped section being used to separate the blocks and hold them down, the strips being let into grooves in the sides of the blocks and bolted down to sleepers bedded in concrete. James Judge, of New York city, is the inventor.

FEED WATER HEATER.—Hollow grate bars and a novel connection of the same with the feed pump and steam generator are the features of this invention. The arrangement is ingenious and practical in its details, and will doubtless prove economical in use. G. W. Jones, of Nashville, Tenn., is the inventor.

CAR COUPLING.—John W. Gillam, of Newton, N. J.—This is a double clutch coupling, having flexibility to adapt itself to the motion of the cars, and positive in its connection, which it makes automatically when the cars are run together. The uncoupling is accomplished by a chain winding upon the vertical shaft of a hand wheel placed on the platform of the car, so that the danger of being crushed by passing between the cars, as in the old method of coupling, is wholly avoided.

SAFETY STOVE FOR RAILWAYS.—This stove is provided with a weighted bottom and a combustion chamber above the firebox; also with a chamber at the top for containing material for extinguishing the fire, which material is automatically discharged upon the burning fuel in case of accidents. The devices by which this result is accomplished are ingenious, and the general idea of the invention is a good one. It deserves the attention of railway officials. Julien T. Evens, St. Louis, Mo.

STEAM ENGINE.—O. M. Pike, of Chicopee, Mass.—This invention pertains to the valve gear and method of reversing steam engines of all classes, but is more specially applicable to locomotive engines. A four ported oscillating valve is employed, over which a block called the valve block slides, a change in the position of this block relatively to the valve, by the reversing lever, changing the induction to exhaust ports, and *vice versa*.

IMPROVED ROOF FOR BUILDINGS.—Nelson G. Northrup, Bloomington, Minn.—The object of this invention is to supply a strong, cheap, durable roof, not liable to leak. The principal features of the invention are the construction of the ridge plate and the employment of boards jointed upon their edges in a peculiar manner, said boards being hollowed or concaved towards the middle from the edges, and the joints being covered by concavo-convex metallic strips or caps.

WATER WHEEL.—This invention is an improvement in scroll water wheels horizontally discharging, and is of a nature incapable of description without diagrams. The object is the construction of a powerful and efficient wheel, adapted to use under varying supplies of water, the wheel maintaining its velocity constant or nearly so, but of course decreasing in power with diminished supply.

CAR BRAKE.—John W. McGlashan, of Montreal, Canada.—This is an arrangement of levers, links, etc., whereby the brakes can be simultaneously applied to all the cars in a train by simply pulling a cord in any part of the train, the brakes being released by releasing the cord. The power for actuating the brakes is derived, through a friction wheel, from the axle of the car.

WOOD PULP MACHINE.—James Taylor, Luzerne, N. Y.—The wood is first cut into small pieces by a series of saws used in combination with the grinder, previous to being fed to the latter. The wood when thus cut passes into a water tank, whence it is carried to the grinder by means of an elevator, together with the proper quantity of water. An expansible and contractible shell is also used on the grinding mill, which enables compensatory adjustment for wear to be made.

DOOR.—Willard C. James, of Fisherville, N. H., has devised an improvement in doors, which consists in dovetailing the mortises and tenons in stiles and crosspieces and wedging them in a way to prevent their sagging, as do doors with the ordinary way of tenoning and mortising.

MACHINE FOR CUTTING GLASS GLOBES, GOBLETS, ETC.—John Thomas, of Turbury, county of Stafford, Eng.—This machine is designed to supersede the use of scissors in cutting flint glass, and to obviate the necessity for the highly skilled labor now necessary in this process. The invention consists in a novel and peculiar way of setting a diamond to adapt it to use for the purpose named.

STEATITE PENCIL.—This invention relates to the combination with steatite of other substances to make a paste for the manufacture of steatite pencils, the paste being manipulated, kneaded, and molded by machinery specially adapted to the purpose. R. Langstrom, of Cincinnati, Ohio, is the inventor.

MACHINE FOR MAKING WOOD MOLDINGS.—J. L. Lane, of Darien, Wis.—This invention relates to machines for cutting spiral or rope moldings. The main feature of novelty is a hollow mandrel in two parts with a cutter head in each, and having detachable rings or dies in each end to hold and guide the strips of wood, which rings can be shifted to suit different sizes of moldings. Improved arrangement of knife stocks and adjusting devices is also claimed.

ADDING MACHINE.—Emery M. Hamilton, New York city.—This is a combination of various devices whereby the operation of adding may be accomplished, the machine carrying and automatically registering the sum totals of the numbers set off upon it. We judge it will compare favorably with other competitors in the same field of invention.

ROOFING BRACKETS.—James H. Look, Jr., Rochester, Mass.—This is an improved support for stagings for the use of carpenters and others in shingling roofs and for other purposes; and it consists in an angular metallic bar made adjustable by means of a screw, and having a hinged claw and adjustable supporting arms. In using the bracket, the claws or teeth penetrate the roof and prevent slipping. The bracket is made adjustable as to hight by means of the screw passing through a screw head. Arms stand at an angle with the screw, and brace the bracket laterally in each direction. This bracket is claimed to be cheap, safe, and convenient, and to possess advantages over anything of the kind in use.

PRINTER'S GALLEY REST.—John M. Murphy, Olympia, Washington Territory.—This is an improvement in an invention patented August 3, 1869, so as to make it simpler in construction, less expensive in manufacture, and more convenient in use.

STEAM WATER HEATER AND PURIFIER.—This is an apparatus composed of various parts combined, to heat water and purify it preparatory to its use in boilers. The construction is quite peculiar, and shows much fertility of resource on the part of the inventor. We judge it to be sound in principle and effective in operation. James Argall, of Mineral Point, Wis., is the inventor.

HAND BRAKE FOR WAGONS.—This is a combination of spring pivoted lever, brake shoe, stop block, etc., in such a way that compound leverage is secured while the brake is rendered double acting, the reaction of one part being utilized to operate the other part. Joseph S. Adgate, of Stevensville, N. Y., assignor to himself and Raymond M. Welles, of Towanda, Pa., is the inventor.

CHURN.—Jacob L. Rust, of Ketchburg, Ill.—This is an oscillating churn vessel with an oscillating reciprocating dasher, by which the inventor claims that the globules of milk are sooner broken and the operation of churning is sooner completed than with other churns.

MANUFACTURE OF HYDROCARBON GAS.—Frederick A. Sabbaton, New York city.—The object of this invention is to furnish a superior quality of hydrocarbon gas for illuminating or heating purposes at a cheaper rate than the ordinary gas has hitherto been produced; and the invention consists in utilizing the heated gases or waste gaseous products of combustion for that purpose, such waste gases being generated in the furnace or fire box beneath the retort in the ordinary process of manufacturing gas, or generated in furnaces employed for other purposes. It also consists in combining with such gases, in a retort, superheated or dry steam, and also in carbureting the hydrogen gas thus obtained in the retort by means of any carbonaceous substance or material, either solid or liquid, as coke, coal, petroleum, naphtha, oil, or any of the hydrocarbons. It is claimed that by this arrangement nearly or quite the whole of the gaseous products of combustion may be made to pass through the retort and utilized as far as the character of those gases will allow. The result of this improvement is a very important saving of fuel in producing a given quantity of gas, while the gas itself possesses superior heating or illuminating power.

TABLES, STANDS, ETC.—Daniel K. Barnhart, Gaines, Pa.—Metal sockets receive the tenons of the legs which may be secured in said sockets by screws passing in through the side of the said sockets and screwing against or into the tenon of the said legs. Upon the upper ends of the sockets are formed arms having holes formed through their ends to receive the screws by which the sockets are secured to the top or leaves of the table, the said arms thus giving to the sockets a broad base. The under side of the top or leaves of the table near the edge or edges has a groove formed in it to receive the edge of the rim, which rim may be made light and thin, and, if desired, strengthened by knees or brackets. In the case of square tables the side arms of the sockets may be extended so as to form bars, provided with holes to receive screws for securing the top or leaves in place. This improvement is designed to be attached to round tables, square tables, center tables, extension tables, stands, etc., and enables firm and substantial tables to be made without any frame.

LAMP BURNER.—Thomas F. Halley and John F. Livingston, Washington D. C.—This invention has for its object to prevent explosions from the overturning or breaking of lighted kerosene lamps, and to this end it consists in the combination with the burner of such a lamp, of a water tank whose contents, in case of accident, extinguish the flame at the wick before it can be reached by the vapor or oil in the lamp.

CLIMBING SANDALS.—Jacob A. and George C. Hanger, Churchville, Va.—This invention relates to sandals to be worn by those who ascend and descend telegraph poles, and it consists mainly in a device whereby a certain toothed jaw, which is placed on the opposite side of the pole from the sandal, may be drawn against or away from the pole, thus clamping the sandal or releasing it from the pole by the operator inclining his foot with the sandal on it more or less to the pole.

MACHINE FOR SHEETING DOUGH.—John H. Shrote, Baltimore, Md.—This invention relates to a machine for forcing dough, when placed in a mass in a receiver, out through a longitudinal slot in the bottom thereof in the form of a sheet by pressure applied from a follower to the dough in the receiver. The machine is so constructed as to remove the sheets of dough thus formed and otherwise economize labor.

BUTTER WORKER.—Luke L. Kellogg, Leon, N Y.—This invention relates to the combination of a vibratory sector shaped tray for receiving butter as it comes from the churn, with a corrugated roller of conical shape placed in stationary boxes for "working" such butter as the tray is vibrated beneath the roller.

AXLE BOX.—David Dalzell, South Egremont, Mass.—This invention relates to an improvement on the invention patented to the same party August 16, 1870. The improvement consists in connecting the two parts of the axle box, namely, the inner wrought iron tube and outer malleable cast iron tube, by means of a screw thread cut on the outside of the end of the tube, and another screw thread cut on the inside of the outer part, so that said parts can be screwed together; and also by means of a tapped hole cut through said outer part and tube, and a threaded wire screwed into said hole, and then cut off flush with the exterior of said outer part.

CANAL BOAT.—Robert Hooper, Baltimore, Md.—This invention consists of a canal boat having a divided introverted bow, that is to say, a bow divided into two parts by a central recess running lengthwise of the boat to any required distance from the stern, the outer parallel sides of the two parts being plane, and the inner converging sides being rounded or convex, as the outer sides usually are; the object of this construction being to prevent the bow from agitating the water, so as to enable the boat to attain a high rate of speed without subjecting the banks of canals to injury from the dashing of waves.

HARVESTER.—Solomon and Isaac Rawson, Almond, N. Y.—This invention consists in the combination of a caster wheel with the inside shoe of the finger bar of a harvester, by means of a spring, the caster wheel being placed in front of the shoe, and the function of the spring being to prevent the transmission, to the shoe and from thence to the finger bar, of shocks received by the caster wheel from striking stones or other obstructions. It also relates to the construction of the socket for the pintle or stem of the caster wheel, whereby said wheel may be adjusted laterally with ease and dispatch.

FURNACE GRATE.—Elijah F. Steele, of Wallingford, Conn.—The outer frame is made of metal, of rectangular or other suitable form, and built into the brickwork or body of the furnace in a suitable manner. The grate is made in two or more sections, each section extending from the back of the frame to the front end of the same. Each section has projecting trunnions, and is thereby hung in boxes. The sections can swing on their pivots or trunnions to be dumped. Each section of grate is composed of longitudinal ribs, and transverse grate bars, the ends of the latter being beveled, so that they will overlap each other. Cranks project from the front ends of the sections, and are connected by a rod, one end of which is pivoted to a lever. This lever is attached to the frame, and can be used to dump the sections simultaneously.

COMBINED CAP AND COLUMN FOR STILLS.—J. E. Morris, Baltimore, Md.—This invention relates to an improvement in the ordinary columnar still cap of cups placed one upon or one besides another, in each of which re-distillation takes place of the liquid condensed from the vapor vent up into the cap from the still. The invention consists in the means hereinafter described whereby a rectification of the spirit is made to take place in each cup of the columnar cap at the same time with the re-distillation above referred to.

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117,237.—COUNTERSINK.—S. J. Abbott, Deering, Me.
117,238.—STRAW CARRIER.—O. Abell, Witoka, Minn.
117,239.—TELEGRAPH.—G. L. Anders, Boston, Mass.
117,240.—RECORD BOOK.—H. Arden, Brooklyn, N. Y.
117,241.—TANNING.—A. T. Atherton, Lowell, Mass.
117,242.—LEVER STAFF.—W. E. Banta, Springfield, Ohio.
117,243.—RAKE TEETH.—J. B. L. Bartlett, North Jay, Me.
117,244.—WATER WHEEL.—J. Bell, Carrollton, Mo.
117,245.—GUN LOCK.—W. N. Bennett, Illyria, Iowa.
117,246.—BLAST FURNACE.—H. Bessemer, London, England.
117,247.—FURNACE.—H. Bessemer, London, England.
117,248.—CONVERTER.—H. Bessemer, London, England.
117,249.—CASTING METALS.—H. Bessemer, London, England.
117,250.—FURNACE.—H. Bessemer, London, England.
117,251.—BOILER.—N. L. Blanchard, Spuyten Duyvil, N. Y.
117,252.—BLOWER.—N. L. Blanchard, Spuyten Duyvil, N. Y
117,253.—SPRING.—P. Broadbooks, Batavia, N. Y.
117,254.—BOILER.—G. H. Buckley, Quincy, Ill.
117,255.—GUTTER.—A. K. P. Buffum, Gardiner, Me.
117,256.—PRESERVING FRUIT.—J. W. Campbell, Phila., Pa.
117,257.—VEHICLE.—J. F. Cass, L'Orignal, Canada.
117,258.—HARROW.—J. C. Center, Mason City, Ill.
117,259.—SAWING MACHINE.—C. Collins, Jonesborough, Ind.
117,260.—LAMP SHADE.—M. H. Collins, Chelsea, Mass.
117,261.—STOVE LEG.—J. M. Corbin, Liberty, Mo.
117,262.—SEWING MACHINE.—T. Crane, Fort Atkinson, Wis
117,263.—GATE.—P. S. Crawford, Union, Ill.
117,264.—HARVESTER.—J. Crossland, Spencer Grove, Iowa.
117,265.—WASHING MACHINE.S.Decker,F.Ayres,Rahway,N.J.
117,266.—MOLDING MACHINE.—J.Demarest,Mott Haven,N.Y.
117,267.—MILLSTONE.—A. Dewey, Princeton, Ky.
117,268.—ELECTRIC INSTRUMENT.L.L.Duerden,Brooklyn,N.Y.
117,269.—TOBACCO CUTTER.—W. T. Farre, Montreal, Canada.
117,270.—KITE.—I. Ferris, Cincinnati, Ohio.
117,271.—TREATING RICE, ETC.—R. B. Fitts,Philadelphia,Pa.
117,272.—WIRE BLANK.—C. W. Goodhue, Lowell, Mass.
117,273.—PENCIL CASE.—F. R. Goulding, Boswell, Ga.
117,274.—BARREL HEAD.—S. S. Gray, Boston, Mass.
117,275.—WIRE FENCE.—B. Greening, Hamilton, Canada.
117,276.—FIREPLACE.—J. Hackett, Louisville, Ky.
117,277.—STOOL.—A. Hallowell, E. Elliott, C. A. Blodgett, Lowell, Mass.
117,278.—CORKSCREW, ETC. J. Harrigan, Ft. Wadsworth, N.Y.
117,279.—CULTIVATOR.—N. J. Harris, Meredosia, Ill.
117,280.—MOTION.—J. G. Harroun, Sag Harbor, N. Y.
117,281.—INCENSE BURNER.—E. W. Hastings, Boston, Mass.
117,282.—REFLECTOR.—A. Haye, New York city.
117,283.—BOOT HEEL.—C. H. Helms, Poughkeepsie, N. Y.
117,284.—CLOCK.—G. Herrmann, Newport, R. I.
117,285.—AIR COMPRESSOR.—M. Hey, Philadelphia, Pa.
117,286.—PAVEMENT.—I. H. Hobbs, Philadelphia, Pa.
117,287.—SOLE.—S. H. Hodges, Lynn, Mass.
117,288.—RUB STICK.—A. J. F. Howard, Milford, Mass.
117,289.—VENTILATOR.—J. L. Howard, Hartford, Conn.
117,290.—EVAPORATOR.—J. Howarth, Salem, Mass.
117,291.—WRINGER.—C. H. Hudson, New York city.
117,292.—STOVE.—G. G. Hunt, Chicago, Ill.
117,293.—KNITTING MACHINE.—L. B. Hunt, Hyde Park, Mass.
117,294.—MANTEL.—D. K. Innes, W. W. Magill, Cincinnati, O.
117,295.—SOWER. G.Jessup,Shortsville,D.P.Sharp,Ithaca,N.Y
117,296.—CORN HUSKER.—J. F. Johnson, Carthage, Ill.
117,297.—DIGGER.—R. Jones, Cleveland, Ohio.
117,298.—EXCAVATOR.—T. Jones, Washington, D. C.
117,299.—KNITTING MACHINE. L.Kavanaugh,Waterford,N.Y
117,300.—WHEEL.—H. D. and J. T. Keith, Mansfield, Ohio.
117,301.—PAINT.—M. W. Kidder, Lowell, Mass.
117,302.—LOCK.—W. Kock, Cincinnati, Ohio.
117,303.—FORGE.—W. T. Kosinski, Philadelphia, Pa.
117,304.—CLAMP.—J. Kunstler, Collinsville, Conn.
117,305.—REGULATOR.—E. Lawler, Hartford, Conn.
117,306.—DETACHING HORSES.—G.B.Lumpkin,Lexington,Ga
117,307.—PLOW.—M. N. Lynn, New Albany, Ind.
117,308.—LOCOMOTIVE.—I. P. Magoon, St. Johnsbury, Vt.
117,309.—SADDLE TREE.—J. H. Martin, Columbus, Ohio.
117,310.—HEATER.—J. McConn, Philadelphia, Pa.
117,311.—STEAM BOILER.—J. McConn, Philadelphia, Pa.
117,312.—CRANK GEAR.—T. J. McGowan, Cincinnati, Ohio.
117,313.—PRINTERS' INK.—C. McIlvaine, Philadelphia, Pa.
117,314.—COPYING INK.—C. McIlvaine, Philadelphia, Pa.
117,315.—SETTEE.—H. T. Morse, Athol, Mass.
117,316.—WASHER.—A. C. Neall, Philadelphia, Pa.
117,317.—PLOW.—B. F. Neely, Yorktown, Ind.
117,318.—CAMERA.—O. W. Noble, Darlington, Wis.
117,319.—GRATE.—C. M. Northrup, New York city.
117,320.—CHIMNEY.—S. Oakman, Boston, Mass.
117,321.—BOOT RACK.—J. K. Otis, East Cambridge, Mass.

117,322.—DUMPING MACHINE.—M. Phillips, Springfield, Ill.
117,323.—NEEDLE WRAPPER.—J. Pitzler, New York city.
117,324.—NEEDLE WRAPPER.—J. Pitzler, New York city.
117,325.—FENCE.—S. S. Porter, Broad Ford, Pa.
117,326.—SAP SPOUT.—C. C. Post, Hinesburg, Vt.
117,327.—ROOF.—M. M. Price, Nether Providence, Pa.
117,328.—COUPLING.—F. B. Prindle, Southington, Conn.
117,329.—PARLOR SKATE.—C. Raitz, San Francisco, Cal.
117,330.—HARROW.F.P.L.Reimers,H.Asbahr,Davenport,Iowa.
117,331.—HAND LAMP.—H. J. Rice, Cincinnati, Ohio.
117,332.—DOVETAIL.—J. B. Ritchey, Pomeroy, Ohio.
117,333.—COUPLING.—F. W. Robinson, Richmond, Ind.
117,334.—MORTISE.—J. M. Rodkey, Indiana, Pa.
117,335.—PLOW.—M. P. Rose, Napa, Cal.
117,336.—CARROUSAL.—W. Schneider, Davenport, Iowa.
117,337.—TRUCK.—C. F. Scoville, Chicago, Ill.
117,338.—MEDICAL COMPOUND.—C. A. Simmons, Waldo, Fla.
117,339.—LIFTING MACHINE.—C. A. Simmons, Waldo, Fla.
117,340.—SAWING MACHINE.—A. E. Smith, Libertyville, Ill.
117,341.—LAMP CHIMNEY.—D. E. Somes, Washington, D. C.
117,342.—FLAX BRAKE.—M.B.Southwick,Mt. St. Hillaire,Can.
117,343.—MOLD.—D. M. Sprogle, Annapolis, Md.
117,344.—BRAID GUIDE.—E. C. Sproul, Green Point, N. Y.
117,345.—SHIP.—E. M. Strange, New York city.
117,346.—FAN.—E. D. Swartwout, Chicago, Ill.
117,347.—BUCKLE.—S. C. Talcott, Ashtabula, Ohio.
117,348.—KEY.—J. Terry, Jr., S. McG. Hunter, Terrysville, Ct.
117,349.—PACKING BOX.—J. W. Tuttle, Newton, Mass.
117,350.—PACKING BOX.—J. W. Tuttle, Newton, Mass.
117,351.—CHAIR.—L. Van Orden, Cincinnati, Ohio.
117,352.—CUTTING CLOTH.—E. B. Wells, New York city.
117,353.—WASHING MACHINE.—D. Werst, South Bend, Ind.
117,354.—NEEDLE HOLDER.—H. H. Wescott, Portland, Me.
117,355.—PAPER.—S. Wheeler, Albany, N. Y.
117,356.—BOILER.—R. C. Whitehouse, Hodgdon's Mills, Me.
117,357.—SET SCREW.—E. Wilder, Springfield, Mass.
117,358.—SEWING MACHINE.—F. R. Wolfinger, Chicago, Ill.
117,359.—SEWING MACHINE.—F. R. Wolfinger, Chicago, Ill.
117,360.—FURNACE.—S. F. Ambler, Monitor, Cal.
117,361.—SEEDER, ETC.—M. Baer, Logansport, Ind.
117,362.—ENGINE.—G. H. Bailey, H. H. Beritt, Newark, N. J.
117,363.—TREATING ORES.—J. W. Bailey, Hamilton, Nev.
117,364.—SEWING MACHINE.—S. J. Baird, Waynesborough, Va.
117,365.—CUTTER.—J. G. Baker, Phila., Pa.
117,366.—METER.—W. Ball, New Vienna, Ohio.
117,367.—CAP GUN.—J.C.Bandle, E.P.Christner, Cincinnati, O.
117,378.—COUPLING.—P. C. Barlow, Beverly, W. Va.
117,369.—PLANTER, ETC.—C. W. Barrick, Walkersville, Md.
117,370.—CANOPY.—L. M. Bates, Wooster, O.
117,371.—COUPLING.—J. H. Beatty, Franklin, Pa.
117,372.—STEAM TRAP.—R. Berryman, Hartford, Conn.
117,373.—STOVE.—W. T. Black, Erie, Pa.
117,374.—FANNING MILL.—F. E. Bowen, Knightstown, Ind.
117,375.—CHALK LINE.—E. Braley, Carmel, Me.
117,376.—SIGN.—A. Brandon, New York City.
117,377.—MOLDING CIGARS.—W.D.Brewer, Charlestown, Mass.
117,378.—TRANSPLANTER.—J. W. Brook, Lynchburg, Va.
117,379.—INSECT GUARD.—J. W. Brook, Lynchburg, Va.
117,380.—SEWING MACHINE.—W. H. Buker, Johnstown, N. Y.
117,381.—FARM GATE.—W. D. Carlton, Morrisville, N. C.
117,382.—FURNACE.—H. Chess, Pittsburgh, Pa.
117,383.—CLAMP.—J. Church, St. Louis, Mo.
117,384.—ROOFING.—J. B. Cornell, New York city
117,385.—GENERATOR.—G. H. Corliss, Providence, R. I.
117,386.—JOURNAL BOX.—G. H. Corliss, Providence, R. I.
117,387.—RAFT CLIP.—I. Corwin, Defiance, O.
117,388.—CARTRIDGE.—J. S. Crary, Salem, N. Y.
117,389.—LOOM HARNESS.—J. H. Crowell, Providence, R. I.
117,390.—AXLE BOX.—D. Dalzell, South Egremont, Mass.
117,391.—MATCH PLATE.—J. R. Davies, Racine, Wis.
117,392.—SPRING SEAT.—E. F. Dunaway, Cincinnati, O.
117,393.—SOUNDING BOARD.—J. B. Dunham, E. Chester, N. Y.
117,394.—PRESSURE GAGE.—J. B. Eads, H. Flad, St. Louis, Mo.
117,395.—FLOUR BOLT.—E. V. Easley, Johnson City, Tenn.
117,396.—SHIELD.—H. H. Edgerton, Fort Wayne, Ind.
117,397.—CAR WHEEL.—J. W. Ells, Pittsburgh, Pa.
117,398.—FIRE ARM.—V. Fogerty, Boston, Mass.
117,399.—LANTERN.—F. M. Ford, Sebec, Me.
117,400.—WASHING MACHINE.—C. Fortin, Poultney, V.
117,401.—LATCH.—C. H. Freitag, Springfield, Ill.
117,402.—STOPPER.—J. R. Gibson, J. Powell, Cincinnati, O.
117,403.—GATE.—R. Gidley, Moore's Mill, N. Y.
117,404.—GANG PLOW.—J. H. Glass, McGregor, Iowa.
117,405.—STILL.—J. Gracie, Pittsburgh, Pa.
117,406.—STILL.—J. Gracie, Pittsburgh, Pa.
117,407.—CORPSE CASE.—J. Gravenstin, Phila., Pa.
117,408.—REFRIGERATOR.—J. Gravenstine, Phila., Pa.
117,409.—HARVESTER.—S. J. Green, Syracuse, N. Y.
117,410.—THRASHING MACHINE.—C. S. Hall, Rochester, N. Y.
117,411.—CHEESE VAT.—S. P. Halleck, Oriskany, N. Y.
117,412.—LAMP.—T. F. Halley, J. F. Livingston, Wash'n., D. C.
117,413.—TELEGRAPH POLE.—J. A. Hanger, G. C. Hanger, Churchville, Va.
117,414.—CLOTHES DRYER.—O. H. Harding, D. G. Williams, Quincy, Mich.
117,415.—DIGGER.—R. A. Haw, Bucksport, Cal.
117,416.—HEATER.—J. Head, Andover, N. Y.
117,417.—STOVE.—Levi Hermance, Lansingburgh, N. Y.
117,418.—GATE.—Edmund Higgins, Sacramento, Cal.
117,419.—CANAL BOAT.—R. Hooper, Baltimore, Md.
117,420.—SPIKE EXTRACTOR.—W. S. Hough, Johnstown, Pa.
117,421.—RAZOR STROP.—O. B. Howard, Westbrook, Me.
117,422.—ELASTIC TIRE FOR ENGINE.—O. Hyde, Oakland, Cal.
117,423.—PAPER BOX.—G. L. Jaeger, New York city.
117,424.—BEDSTEAD.—L. J. Johnson, Cleveland, Ohio.
117,425.—HYDROCARBONS.—J. J. Johnston, Allegheny, Pa.
117,426.—HYDROCARBONS.—J. J. Johnston, Allegheny, Pa.
117,427.—BOILER.—M. L. Keen, Jersey City, N. J.
117,428.—BUTTER WORKER.—L. L. Kellogg, Leon, N. Y.
117,429.—WASHING MACHINE.—E. D. Kitchen, Pineville, Pa.
117,430.—FURNACE.—R. F. Knox, J. Osborn, San Francisco, Cal.
117,431.—GATE.—W. H. Kosht, Ashland, Ohio.
117,432.—TRIP HAMMER.—John Krehbiel, Williamsville, N.Y.
117,433.—INDEX BOOK.—J. B. Lake, Jr., Baltimore, Md.
117,434.—WINDMILL.—L. Leach, Wilmington, Ill.
117,435.—SAFE.—S. M. Lillie, Elizabeth, N. J.
117,436.—PEG WOOD.—W. N. Linnell, Cambridge, Mass.
117,437.—CANAL BOAT.—F. M. Mahan, Memphis, Tenn.
117,438.—STOP COCK.—P.E.Malmstrom, P.Dummer, New York.
117,439.—HAIR CURLER.—C. Markley, New York city.
117,440.—BEDSTEAD.—T. A. McFarland, Erie, Pa.
117,441.—DITCHER, ETC.—J. I. Mettler, Mendota, Ill.
117,442.—TIME CHECK.—A. Meyer, Stuttgart, Germany.
117,443.—MEASURER.—I. Mills, Hamilton, Canada.
117,444.—ALARM.—John Morgan, Jr., Wheeling, W. Va.
117,445.—SPIRIT STILL.—J. E. Morris, Baltimore, Md.
117,446.—CHURN DASHER.—H. Mulholland, Union Mills, Pa.
117,447.—RUBBER HOSE.—John Murphy, New York city.
117,448.—BOILER.—T. J. Myers, Philadelphia, Pa.
117,449.—RAILWAY TIE.—W. A. Nichols, Mattawamkeag, Me.
117,450.—STEAM PUMP.—T. O'Rorke, Pittsburgh, Pa.
117,451.—WATER WHEEL.—C.W.Parker, Genesee Forks, Pa.
117,452.—CHIMNEY CLEANER.—R.Pearson, Allegheny City, Pa.
117,453.—COUPLING.—W. V. Perry, Beaver Dam, Wis.
117,454.—POWER.—A. C. Platt, Sandusky, Ohio.
117,455.—SEPARATING TANNIN.—N. C. Platt, Salisbury, N. Y.
117,456.—BRUSH.—T. G. Porter, Louisville, Ky.
117,457.—SAP SPOUT.—C. C. Post, Hinesburg, Vt.
117,458.—STEAM ENGINE.—E. Post, Boston, Mass.
117,459.—SEWING MACHINE.—J. Ramsey, Jr., Middletown, Ct.
117,460.—HARVESTER.—S. and I. Rawson, Almond, N. Y.
117,461.—FIREARM.—C. B. Richards, Hartford, Conn.
117,462.—PREVENTING INCRUSTATION.—W. T. Rickard, New Monitor, Cal.
117,463.—PUMP.—W. F. Robinson, Bellaire, Ohio.
117,464.—OVEN.—W. S. Robinson, Oskaloosa, Iowa.
117,465.—PILE DRIVER.—H. Roehrs, Washington, D. C.
117,466.—STOP VALVE.—R. P. Ross, Bethlehem, Pa.
117,467.—SCHOOL DESK.—J. Russel, Plymouth, Ind.
117,468.—SCREW PRESS.—M. Safford, Melrose, Mass.
117,469.—WATER WHEEL.—D. Sandoe, Orangeville, Ill.
117,470.—LAMP.—W. G. Schmidlin, Hoboken, N. J.
117,471.—BLIND SLAT.—P. Schumacher, San Francisco, Cal.
117,472.—WASHING MACHINE.—C. T. Shadbolt, Attica, N. Y.
117,473.—PULVERIZER.—G. Shelton, Normal, Ill.
117,474.—SHEETING DOUGH.—J. H. Shrote, Baltimore, Md.
117,475.—COUPLING.—T. W. Sparks, Rochester, N. Y.
117,476.—COOKING OVEN.—E. Sperry, Chicago, Ill.
117,477.—MOLDING.—E. A. Stockton, San Francisco, Cal.
117,478.—LOCK.—E. Stockwell, Stamford, Conn.
117,479.—CHURN DASHER.—B.F.Stover, Ladoga, I.W.Warner, Crawfordville, Ind.
117,480.—STEAM BOILER.—D. Sullivan, Bangor, Me.
117,481.—HOLDER.—N. H. Talbot, North Easton, Mass.
117,482.—CIGAR MACHINE.—G. W. Tanner, Providence, R. I.
117,483.—VISE.—T. Terrell, Yonkers, N. Y.
117,484.—VENTILATOR.—W. F. J. Thiers, New York city.
117,485.—GARDEN TOOL.—A. Tournier, Barnville, N. Y.
117,486.—GLOBE.—T. Trudeau, Ottawa, Canada.
117,487.—FLUTING MACHINE.—T. M. Tucker, Newark, N.Y.
117,488.—WINDMILL.—T. S. Van Devort, Ypsilanti, Mich.
117,489.—FLY TRAP.—E. Victor, Fort Branch, Ind.
117,490.—TOURNURE.—A. Waldmann, Philadelphia, Pa.
117,491.—COTTON PRESS.—G.P.Webster, Jr., Cross Bridge, Ten
117,492.—SPARK ARRESTER.—W. A. West, Bellefontaine, O.
117,493.—CUT OFF.—C. Avery, J. W. Wetmore, Erie, Pa.
117,494.—TUBE REDUCER.—E. Wheeler, Philadelphia, Pa.
117,495.—BOLT CUTTER.—John Whittaker, Sandusky, N. Y.
117,496.—TRANSPORTING EGGS.—H.Willard, G. Rapids, Mich.
117,497.—LAND ROLLER.—W. Wimer, Freeport, Ill.
117,498.—CAR WHEEL.—J. A. Woodbury, Boston, Mass.

REISSUES.

4,479.—Division A.—TREATING COFFEE.—John Ashcroft, Brooklyn, N. Y.—Patent No. 113,812, dated April 18, 1871.
4,480.—Division B.—TREATING COFFEE.—John Ashcroft, Brooklyn, N.Y.—Patent No. 113,832, dated April 18, 1871.
4,481.—TRIMMING MACHINE.—E. J. Beane, Providence, R. I.—Patent No. 43,082, dated June 14, 1864.
4,482.—HAT LINING, ETC.—T. W. Bracher, New York city.—Patent No. 110,891, dated January 10, 1871.
4,483.—FIREARM.—William C. Dodge, Washington, D. C.—Patent No. 45,912, dated January 17, 1865.
4,484.—HARVESTER.—Ketchum Harvesting Machine Co., Buffalo, N.Y.—Patent No. 20,719, dated June 29, 1858.
4,485.—CULTIVATOR.—A. Kinyon, Amboy, Ill.—Patent No. 45,503, dated Dec. 20, 1864.
4,486.—MELODEON.—El Dora Lewis, New York city.—Patent No. 16,094, dated Nov. 18, 1856; reissue No. 2,498, dated Feb. 26, 1867; reissue No. 2,944, dated May 26, 1868; extended seven years.
4,487.—BUILDING.—B. M. Nyce, Cleveland, Ohio.—Patent No. 31,734, dated March 19, 1861; reissue No. 3,232, dated January 5, 1869.
4,488.—LOCK.—George Rosner, Rochester, N. Y.—Patent No. 30,092, dated Sept. 18, 1860.
4,489.—CULTIVATOR.—W. S. Weir, Jr., Monmouth, Ill.—Patent No. 46,285, dated Feb. 7, 1865.

DESIGNS.

5,133.—HAND STAMP.—R. B. Carsley, Chelsea, Mass.
5,134.—PAPER BOX COVER.—J.W. Carter, South Orange, N.J.
5,135.—HAND STAMP.—S. P. Cooper, Cincinnati, Ohio.
5,136.—CATTLE HORN KNOBS.—H. J. Frantz, Metamora, Ill.
5,137.—HAND STAMP.—W. B. Gorham, Boston, Mass.
5,138.—GARMENT MEASURE.—E. F. Harmon, Conneaut, Ohio.
5,139.—CARPET PATTERN.—W. Kerr, Philadelphia, Pa.
5,140.—HOLLOW TILE.—B. Kreischer, New York city.
5,141.—COOKING RANGE.—A. Richmond, Brooklyn, and S. G. Richmond, Norwich, Conn.
5,142 and 5,143.—GROUP OF STATUES.—J. Rogers, New York.
5,144.—GRATE.—N. H. Talbot, North Easton, Mass.
5,145.—BASKET RACK.—M. Tower, Boston, Mass.

TRADE MARKS.

387.—MEDICINE.—H. M. Billings, New York city.
388.—INK.—Carter Brothers & Co., Boston, Mass.
389.—WHISKY.—Julius Dorn, Louisville, Ky.
390.—CANDLE.—C. Harkness, Cincinnati, Ohio.
391 to 395.—NET AND LACE GOODS.—A.G.Jennings, New York.
396.—MEDICINE.—John Q. Kellogg, Brooklyn, N.Y.
397.—SHAWL.—F. Steffan & Co., Philadelphia, Pa.
398.—MINERAL WATER.—The Congress and Empire Spring Co., Saratoga Springs and New York city.
399.—SEWING MACHINE.—J. H. Whitney, Paterson, N. J.
400.—TOBACCO.—T. C. Williams, J. Thomas, Jr., Richmond, Va.
401.—BEVERAGE.—E. J. Williamson, St. Louis, Mo.
402.—TOBACCO.—Winfree & Loyd, Lynchburg, Va.

APPLICATIONS FOR EXTENSION OF PATENTS.

GRINDING AND POLISHING MACHINE.—Daniel Lovejoy, Lowell, Mass., and Elizabeth S. Butterfield, Rockingham, Vt., have petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

MOWING MACHINE.—John P. Manny, Rockford, Ill., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

CULTIVATOR.—Nicholas Whitehall, Attica, Ind., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

Value of Extended Patents.

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

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Inventions Patented in England by Americans,

July 4 to July 10, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.

ARTIFICIAL STONE.—R. Skinner, San Francisco, Cal.
BED BOTTOM.—J. F. Peck, Springfield, Mass.
FIRE-PROOF SAFE.—John Farrel, New York city.
GOVERNOR.—D. Shrive, Philadelphia, Pa., residing at London, Eng.
LENSES.—T. A. Willson, Reading, Pa.
LUBRICATOR.—H. A. Clark, Boston, Mass.
METALLIC BAND.—G. Brodie, Plum Bayou, Ark.
PAVEMENT, ETC.—D. Brennan, Orange, N. J.
RAILWAY WHEEL.—S. F. Phelps, New York city.

Practical Hints to Inventors.

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How Can I Obtain a Patent?

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

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Preliminary Examination.

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To Make an Application for a Patent.

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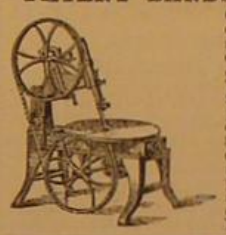

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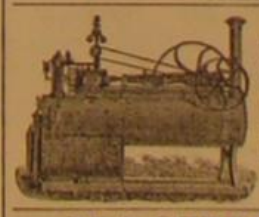

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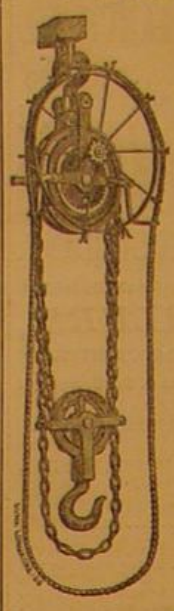

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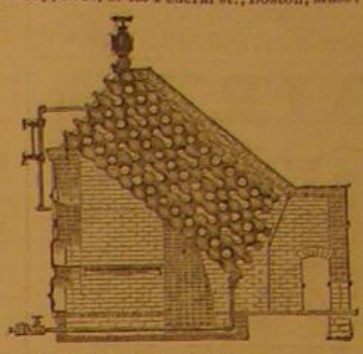

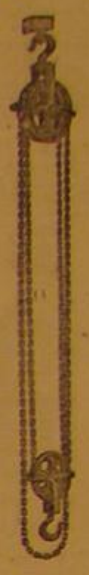

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SCIENTIFIC AMERICAN

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Vol. XXV.--No. 7. [NEW SERIES.] NEW YORK, AUGUST 12, 1871. $3 per Annum. [IN ADVANCE.]

THE NEW POST OFFICE, MELBOURNE, AUSTRALIA.

It is many years since the idea of a General Post office, suited to the requirements of a colony so progressive as Victoria, was first conceived. It is, after all, simply a question of time whether other institutions of as much importance as the General Post should not be completed in accordance with the original views of promoters.

The architect of this building is Mr. Wardell; its frontage in Bourke street is 130 feet, and that to Elizabeth street 316 feet. The stone used in the front of the building is freestone from Tasmania quarries, the greater portion being from each pier, and filled in with moulded blue stone steps. These steps extend beyond the plinth, and form a continuous flight to the arcades. The arcades are 10 feet wide in the clear, divided by piers and molded cross ribs at each bay, and vaulted over with Roman groining in brick. The north front is of plain brickwork, and the basement throughout is of chiseled bluestone ashlar. The middle compartment is divided into centre and wings, the center being relieved by a screen of eight detached coupled columns of the Ionic order, terminating with balustrades above. The pedestals over the columns are to have statues or carved terminations. The walls to the center portion of the ground space form a central area carried a balustrade and attic. Each front between the towers and central compartment in Elizabeth street is finished with a balustrade. The upper story consists of pilastered arched headed windows, with balconettes continuing the line of pedestal to the upper order, the impost to the window being continued. Engaged coupled columns mark each bay, and the towers are relieved with pilasters and columns, with detached shafts on each face extending to the three orders, the cornices breaking round. The columns with detached shafts are fluted, and the windows to the central compartment and towers have fluted Ionic columns. In the wings to the central compartment arched heads are omitted, and the spaces

THE NEW POST OFFICE, MELBOURNE, AUSTRALIA.

Point Ventenat, Taylor's Bay, and the remainder from Spring Bay.

The principle entrance to the building is in Bourke street, leading to an arcade by a flight of steps to the mail branch department, from which access is gained to the offices of the general secretary, the inspector of country post offices, and the inspector of stamps. An arcade extends along the Bourke and Elizabeth street fronts of the building, affording general access to the receiving, delivery, and inquiry windows, registration, sale of stamps, and private letter boxes. At the north end of Elizabeth street the arcade affords access to a staircase on the first floor, where the money order office and the dead letter office are located, and forms the public approach to the accountant's department. On this floor are also the stationery store, clerks' offices, corridors, etc. The mail branch department occupies the whole of the ground floor, affording a clear space throughout, except where interrupted by the piers continued the whole length of the two street fronts.

On account of the inequality of street level a basement is formed, commencing at above 12 inches above the footpath in Little Bourke street, and standing 4 feet 6 inches above the foot path at the corner of Bourke and Elizabeth streets. The portions of basement exposed to view are of red granite, and finished with a rusticated capping, forming a sub-plinth t up to the full hight of the building, and lighted from above, to be used as a sorting room, around which are placed successively the stamp, registration, and inquiry windows, and the newspaper and letter delivery, as well as private letter windows; these are on the south side, facing Bourke and Elizabeth streets. On the eastern or rear side of the building is the mails receiving room, entered from the right-of-way joining Bourke street with Little Bourke street. The inland and foreign despatch, with outside approach is on the western side, and the letter carriers' room is on the north side. By this arrangement, supervision is obtained by the superintendent in the sorting room over the whole of this department. Washing rooms and water closets are provided on each floor. The basement, on the rear side of the building, is appropriated for storerooms, etc.

The architecture is of Ionic and Doric orders, superimposed after the Italian manner. The angles of the building and the main central compartment of the long Elizabeth street front break forward beyond the general face, and form in the complete design, angle towers to both street fronts. The main central compartment and angle tower abutting on both streets is carried up another story with the Corinthian order. The angle tower is surmounted by a turret of octagonal form with clock dials on four sides. The two remaining angle towers are of less elevation, and are simply terminated with above are filled with sunk panels and carved festoons. The angle tower connecting the arcades to the two streets is domed in brick. The hight of the lower order from the level of the basement is 21 feet 6 inches, and the upper order, including pedestal and parapet, 30 feet 6 inches. The hight of the angle tower abutting on Bourke and Elizabeth streets is 98 feet above the footway. The central compartment is 92 feet 6 inches to the top of the masonry. The remaining parts are 60 feet high. The roofs are of wrought iron, and covered part with slate and part lead. On the third floor, an attic room is provided, for storage and extra office accommodation, as well as living rooms for messengers. A space is set apart on the basement for heating the mail branch department with hot water.

IN the Black Sea, says the *Builder*, there are no tides, but the level of the water along the shore is considerably influenced by the action of the wind. Near the mouth of the Danube it varies from eighteen inches below the mean sea level, when the wind is from the west or off the land, to two feet above that level when the wind is landward or from the east.

A TRAIN recently ran 132 miles in two hours and fifty minutes, on the Pennsylvania Railroad, recovering fifty minutes of lost time.

EXPERIENCES OF A BUREAU OFFICER.

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

Of direct bribes there are few tendered, and, I apprehend, so few accepted, that this method, considered as a mode of influencing the minds of officials in the Patent Office, may as well be laid out of the consideration of ordinary applicants. It is not uncommon to find outsiders trading on the strength of the supposed corruption of officials or of Congressmen; but I think, as a rule, money paid for the purpose of influencing either rarely goes beyond the pockets of the self appointed agent. One of the examiners once brought me a fifty dollar bill, which had been left on his table in an envelope, which also contained a request for a private interview. At my suggestion he wrote declining the interview, and notifying the gentleman that he could have his money by applying to the Commissioner. A day or two afterwards a tall and sheepish looking individual appeared and demanded the fifty dollars. He was required to give a receipt in due form for the money; and, I think, will hardly care to repeat the experiment. A meaner trick was the practice of paying a young man in the office a debt long due to his widowed mother, by a check, payable at a point so distant that it was supposed that it could not be collected until the young man had acted in the case submitted to him. The young gentleman, who is a thoroughly upright man, called my attention to the case, and all proceedings were suspended by order until the check was heard from. It was returned dishonor d. There were no funds in the bank, but the scamp was caught. His case was still in abeyance, and rather than risk the action of a man upon it, whom he had just attempted to swindle, he paid the debt in full in good currency.

I believe the officers of the Patent Office to be, as a class, thoroughly honest, efficient, and capable. Some of them who have been long in office have become a little set in their ways and somewhat restive under criticism, and not unfrequently their resulting obstinacy seems to the mind of an applicant, under the fostering suggestion of his solicitor, to be dictated by some corrupt motive of opposition. Nearly every inventor fears his shadow. Every pillar in the Patent Office is a lurking thief waiting to filch his invention. He thinks the Commissioner, the examiners, even the very laborers and messenger boys, must know what a fortune there is in his new invention, and that the study of their lives is now to steal it from him. It may be well to remember that the officers who examine 20,000 applications in a single year are as likely to become *blasés* on the subject of new inventions as the ladies who open 500 epistles per day in the Dead-letter Office are said to become upon the subject of love-letters. The most persistent and troublesome form in which it was attempted to commit the Commissioner to improper official acts, was in the constant attempt to force him into conversation about cases which had been argued but not decided. This practice had unfortunately been permitted under one of the previous administrations, until it was impossible to say when the argument closed, and after oral discussion in the presence of each other, the remaining aim of the parties until the day of decision was to catch the Commissioner alone and to pour into his ear an argument to which opponents were to have no opportunity to reply. It is believed that this evil is now effectually suppressed.

The system of making appropriations for the departments struck me as objectionable. Now, as early as October in each year, every head of a bureau makes his estimates of the number of clerks and the amount of money necessary to carry on operations for the fiscal year beginning on the following July—nine months. In making these estimates, if honest, he is guided by his experience of the past, and his forecast of the future. When Congress meets, his estimates go before the Committee on Appropriations. Here they run the gauntlet of all the would-be economists. Then they pass the ordeal of all the gentlemen who happen to be unfriendly to the bureau, or especially to its head. It will be remembered that one gentleman, in urging an incompetent friend upon me for office, reminded me that he was a member of the Committee on Appropriations. This reminder, under such circumstances, was equivalent to a threat. No one cares to call on the head of the department or bureau for explanation, but each man slashes according to his fancy. Sometimes, what has escaped the committee is decimated by some clerk. The appropriations for the Patent Office were once cut down by apparently striking out arbitrarily every tenth or twelfth line. Curious to understand it, I called upon the committee. No one knew anything about it, or had any objection to the appropriations that had been stricken out. Presently it appeared that the clerk of the committee had exercised *his* supervising care over our estimates by making these erasures, and when the motive was looked for, it was found in the fact that he had unsuccessfully attempted to procure the appointment of a friend in the Patent Office during the preceding summer. A parallel case was found in the rejection at one time at the Treasury Department of an entire quarter's accounts of the Patent Office. The objections were not well founded, and the accounts were subsequently passed. The cause of the temporary annoyance was found in a clerk in the Auditor's Office, whose daughter had been discharged from the Patent Office, and who had informed us that he could, if he would, do us much harm.

It will be seen from these sketches how the present system vitiates and corrupts every department of our system of government. The time spent by government officials in making and listening to applications for office, amounts to fully one-third of the business day. The strife and bitter feelings engendered are sufficient to destroy all proper intercourse between the executive departments and the representatives of the people. The evils of the system are not confined to Washington. They are to be found to a greater or less degree in every State capitol, in every Congressional district. This incubus must be thrown off, or, like the "old man of the sea," it will strangle us. We must have better public servants, selected for their education and capacity, and retained in service as long as their experience is valuable and their bodily powers are intact. The President, by the legislation of the last session, imperfect as it is, has a great opportunity to inaugurate a purer and better system than the country has yet seen. Let him do this, and however politicians may bluster and scold, the sober sense of the people will respond, "Well done, thou good and faithful servant."

The Great Rice-fields at the South.

A Southern correspondent of the *Syracuse Courier* writes of the rice lands:

"There is a belt of land stretching from Virginia down the coast to the Gulf of Mexico, and most of the distance it lies low, very little above the level of the ocean, and some of it is covered with water by every high tide. The greater portion of this land may properly be called swamp land—not altogether given up to the domain of the water, but always damp, and too wet for any grain except rice. It is not every swamp or wet piece of land that is fit for the cultivation of rice. The alluvial swamps lying along the banks of rivers, having a deep soil, composed of decayed vegetables, is best fitted for the purpose, but it must be so located that it can be overflowed at high tide, or it is useless for the purpose. The lands must also be protected from the salt water, and from the rapid currents occasioned by freshets. South Carolina is the great rice State, more being cultivated than in all the United States beside. The rivers flowing down from the table land of the interior reach this low land, and force themselves to the sea, spreading and forming a broad deep channel. There is volume of water sufficient, so that the tide will cause it to set back for many miles. Along many of these ravines, the land is as level as the sea, and it can be flooded at pleasure. Gates are constructed through artificial embankments along the banks of the river, and when the tide is high the water is let in, and the land flooded and the gates closed. When it becomes necessary to draw the water off, the gates are opened at low tide. Some of these fields are very large and interesting when being prepared for a crop, and are very beautiful when the rice comes up through the water and shows its needle-like spears. These fields must have a secure embankment along the river, and must be thoroughly drained by artificial channels, so as to take the water entirely away when necessary. In large fields some of the channels have capacity enough to float a flat bottomed boat, which is used to convey the harvest to the place of storage.

"The land is plowed in winter, and in the first warm days of spring is flooded. The preparation of the ground commences in March. The ground is made as mellow as a garden. The seed is sown in trenches about fifteen inches apart. It requires about three bushels of seed to an acre. The seed is tightly covered with the soil, and the water let in, to remain about a week, by which time the grain sprouts, when the water is drawn off; but when the grain is a few inches above the ground, it is again flooded for four or five days, and then drawn off, and the grain is then allowed to grow for four or five weeks, when it is cultivated and the ground thoroughly stirred; and then the water is let on, and it is flooded for a few days, and then gradually drawn down and again cultivated; and after the second cultivation the water is again let on to remain till the crop matures, which takes about two months, when the water is drawn off, and it is harvested very much as we harvest buckwheat. The crop in a favorable season is a profitable one. The grain is threshed and cleaned in mill. It is frequently sent to market before the hulls are removed. There are extensive mills at Liverpool and New York for hulling the rice, and they enable the dealer to put it on the market fresh and white. There are mills at Savannah and Charleston, where the rice is hulled for the local market. The best hulling machines cost from $15,000 to $18,000, and have very intricate machinery. The rice, before being hulled, is called poddy. The machine takes off the hulls and assorts the grain. After the hulls are removed, it is moved out on inclined screens, which are fine at first, and all the small and broken rice passes through, and then a little coarser, and the rice called 'middling rice' drops through, and last the 'Prince rice.' The latter quality is passed through another screen, which is called polishing, and in that process is swept clean and bright. Rice is cultivated in all the warm countries of the world, and is used for food by more people than any other cereal except wheat. It is cultivated very extensively in the East Indies; and along the coast, where the lands are marshy, it is the only crop raised. It is a staple crop in Africa, the south of Europe, North and South America. Ceylon produces a large quantity in excess of consumption. There are several varieties, some of which grow on dry land, but the Carolina or water-rice, as it is called, is as fine as any in the world. It grows very rapidly, and is often six feet high. When it is sufficiently high to cover and hide the water, it presents a beautiful sight."

Modern Vandalism.

Paris, now the Niobe of cities, has had many of her glories and monuments of her genius destroyed by the rude chances of war; but the unreasoning savagery of the Communists, in deliberately violating the shrines of art and the temples of science, has never been paralleled in the history of the world. There no political or party zeal such as inflames the liberal against the memory of the Empire, no fanatical hatred such as incites the republican to destroy the very symbols of monarchy, can be pleaded in justification. The wilful destruction of libraries, works of art, and models and specimens illustrating all the sciences, which have so long maintained the renown of Paris as a home for all that is best and greatest in art, science, and civilization, is the most unaccountable exhibition of wickedness of modern times. It is a war upon the very knowledge and intelligence that distinguishes man from brute, a deliberate attack on the mind of man and on the works thereof. Surely crime never did more dastardly and more unworthy deeds than the recent acts of violence upon the museums, libraries, and art galleries of Paris.

One of the most intrinsically valuable and most interesting of all the places ravaged was the *chateau* of Arceuil, which has been plundered and its valuable contents wantonly destroyed. A collection, made by the great Laplace, to whose descendant the castle belongs, of rare books, souvenirs, and works of art, has been devastated and scattered to the winds. The author's original manuscript of *La Mécanique Céleste*, that wonderful production of the greatest of modern astronomers, was thrown into the little stream, the Bièvre, which runs by the *chateau;* but the invaluable relic was subsequently recovered. The sacking of the house of Laplace, and the ruin of the relics of his great genius and labors, was accomplished by a horde of ruffians from the neighboring district of Mouffetard.

Advantages of Printing Telegraph Instruments.

"Printers have the advantage of other systems in the reduced liability to errors. In transmitting and receiving dispatches with lines of the conductivity indicated, there can be but one chance for mistakes, and there is less liability to error than in transcribing from one paper to another. The message must be received and printed exactly as it is sent. If an error occurs, it is of course the fault of the transmitter and not of the receiver. Another decided advantage is that they can be worked much more rapidly than any other system, and as soon as the message is complete, it is ready to go to the delivery clerk, to be enveloped and sent to its destination. Working printers is not as exhausting to the operators as other systems, as, when the line and instruments are in proper order, the receiving operator has only to see that the messages agree with the checks. On main circuits, where a large amount of business is to be done, these advantages are of great importance.

Another advantage in employing printing telegraph instruments is the fact that they are always popular with the public, who prefer to receive their despatches in that shape. Other things being equal, printing lines have always had a decided popularity with the public over other systems. With proper lines and insulation, good operators, and such instruments as can now be manufactured, we believe that in ten hours' steady work the printers will do from one half to two thirds more work than any other system now in use in this country."

[We fully concur with the *Telegrapher* in the above estimate of the advantages of the telegraph printing instruments. We wonder that large and flourishing companies like the Western Union do not more extensively employ them. We have seen them worked at the Western Union establishment in this city, both in sending and receiving despatches, when they certainly surpassed the ordinary instruments in rapidity and correctness. Sending messages by key and receiving by sound is a very simple and convenient method, to be sure; but the blunders that are often committed, especially with names, are fearful to contemplate. Then the chirography of many telegraphers is difficult to decipher, having more resemblance to fly tracks or Aztec hieroglyphics than to civilized writing.

The public likes the plain printed style of messages much the best. It would be a popular move on the part of the companies to use the printing instruments exclusively.—EDS.

Car Wheels and Axles.

In an action recently tried in England against a railroad company, it was testified that experience has shown that, by tapping, defects can be detected in the wheels but not in the axles, but that the only way to find out whether an axle is sound or not, is to break it. The plan adopted is to break several specimens taken at random from a lot of axles, in order to find out whether the iron is good. If the test be satisfactory, the rest of the axles are taken on trust. The breaking of railway axles very seldom occurs. In the case before the court, which was an action for damages against the railroad company, arising from injuries caused by the breaking of an axle, it was proved that this particular axle had been in use for eighteen years, and that after it broke a fracture extending around it to the depth of half an inch was discovered. This was the case in the axle which broke recently upon the Maine Central Railway at Freeport.

Extraordinary Positions for Birds' Nests.

The following is vouched for by several English papers: A white-throated wren recently built its nest in the letter-box of the Duke of Rutland's gamekeeper at the Links, near Newmarket, and produced six young ones. During its incubation, the old bird took no notice of the intrusion of the of the persons who went for the letters night and morning. A short distance from this remarkable nest is one built by a lark under the metals on the line of railway between Newmarket and Dullingham. The bird is sitting upon four eggs, and takes no notice of the thirty trains which pass over the line daily.

LEARNING AND UNDERSTANDING.—"How is it, my dear," inquired a schoolmistress of a little girl, how is it that you do not understand this simple thing?" "I do not know, indeed," she answered with a perplexed look, but I sometimes think I've so many things to learn that I have no time to understand."

[For the Scientific American.]

A CHAPTER ON AMERICAN GEOLOGY.

BY CHARLES MORRIS, OF PHILADELPHIA.

In the western corner of the State of Nebraska is a locality fearfully inhospitable to the husbandman, an extensive region untouched by pre-emption claims, and forcing the team of the emigrant, who would seek yet further westward more fertile lands, to wind far and slowly through labyrinthine defiles ere he can pass its difficult barrier.

Yet, though treeless and barren, seldom visited by the kindly waters of the skies, and undimmed by the cabin smoke of the settler, these *Mauvaises Terres*, or "Bad Lands," as they are appropriately named, are to the geologist a true land of promise, no other locality in our country yielding so strange an array of fossil remains.

This region is a veritable mirage to the traveler whose adventurous foot leads him so far into the prairies of the great West. From afar there seem to rise the towers and temples of a mighty city, lifting their fair proportions high into the cloudless air, vast columns as of the capital of some unknown empire of the West. As he approaches, these pinnacles and towers lose their harmonious proportions, and the city sinks into a grand ruin, uplifted in mighty disarray above the level surface of the prairie.

But now, with every step, the mirage fades, and the unlucky Barmecide stops at last before a lofty deposit of hardened clay and marl, through which ages of rain and the slow appetite of running streams have cut, in every direction, cañons, winding in labyrinthine defiles through the *Mauvaises Terres*, rugged passes for the wheels of the dauntless emigrant bound "Westward, Ho!"

Here was, in ancient times, a great fresh water lake, which for ages dropped to its bottom the earthy deposits brought in by the present White river and other streams, till in time the lake was extinguished under its silt of marl, sand, and clay, which has since been uplifted into the elevated and water-worn ruin above described.

The Bad Lands comprise an area of about 100,000 square miles, the lake they represent having covered the most of Western Nebraska, with an area of some 150,000 square miles. From the source of the White River to what is technically known as the Forks, the surface is, geologically, tertiary, having been laid in that grand third age, of the building of the earth, which has yielded in all parts of the globe such marvellous animal remains. Thence to where it merges in the muddy Missouri, it runs through cretaceous beds, strata agreeing in age with those white chalk and green sand deposits of Europe, which are noted as mausoleums of the gigantic sea lizards of the old oceans, whose exhumed bones have been more the marvel and delight of *savans* than aught beside that the earth has yielded, to the chisel and hammer of the indefatigable rock delver.

At some distance from this stream is another, called the Niobrara, running through similar deposits, the tertiary beds stretching from river to river. South of the Niobrara to the Platte river is a second strange region known as the Sand Hills. Here an extensive area is covered with conical hills of sand, constantly shifting before the wind, and frequently scooped out at their summits into incipient craters. This sandy region is not, however, destitute of vegetation, as it forms a favorite grazing range of the buffalo and antelope.

While the waters were slowly filling up these lowlands with the mud denuded from upland regions, leaves of trees and bones of animals dropped or drifted into the lakes and marshes, and, buried in the mud of the bottom, have been preserved intact to our time. Modern naturalists do not ask much. Give them a well defined leaf and they will reconstruct the tree, give them the bones of a skull and they will rebuild an extinct animal. Even this is frequently denied them, a single tooth being sometimes the basis of an animal reconstruction. Fortunately the teeth, the most durable of animal bones, are also the most significant, being full of evidence of the character, race, and food proclivities of their owners.

In the Bad Lands are found the remains of two distinct animal communities, as described by Dr. Leidy, in Dr. Owen's "Geological Report of the North West." While the lowest bed was being deposited, the lake was probably a great marsh, in which wallowed numerous hippopotami of at least two distinct species. But the distinguishing creature of this period was a huge thick skinned animal, named, from his great size, the *Titanotherium*, or Titanic animal. At the period of the second deposits, there roamed the prairies great herds of an ancient species of hog, partly carnivorous, yet chewing the cud like modern ruminating animals. Of this *Oreodon*, as it has been named, were several species, of one of which Dr. Leidy has found remains of more than 700 individuals.

Three species of hyæna inhabited these plains, together with a tiger, with sabre like teeth. Fierce conflicts took place between these beasts, the marks of which still remain in their fossil skulls. In one hyena skull were found two wounds on each side the nose, while near by was another skull whose canine teeth exactly fitted the apertures.

Besides these creatures, no longer found on American soil, there existed two species of rhinoceros, supposed, unlike their African representative, to have been hornless. A gigantic weasel, an immense turtle, and numerous other strange creatures, lived and multiplied here, long before these lands had deserved their sobriquet of "Bad." Great has been the change from the occupation of this region by animals no longer found anywhere on the continent, by a vast lake, and umbrageous forests, to its present treeless and lifeless condition.

But these are not all the organic marvels of the region. The more modern beds of the Niobrara yield an entirely different series of animals, of which more than thirty species have been examined, all new to science. A vast period of time must have elapsed between these two formations, for an extensive series of animals to utterly die out, and a new and distinct series to take its place.

In this new commonwealth lived a species of that American elephant, known as the Mastodon; much smaller, however, than that which afterwards existed. But this dwarf is balanced by a giant, or, as Dr. Leidy has appropriately named it, The Emperor of the Elephants (*Elephas Imperator*). This massive brute was one third larger than any other elephant known, living or fossil, yet to attest his imperial dignity there only remain a few scattered bones.

There lived here, also, native representatives of that sand loving creature which modern legislators have of late sought to re-introduce to his old range on the Western plains. No less than four species of camels roamed here, unburdened and unridden. Besides these there was a rhinoceros, resembling that now living in India, two species of deer, an animal like the mountain sheep, a ruminant hog resembling the oreodon, a porcupine, a small beaver, four species of wolves, two animals of the cat tribe, and various others.

Another animal has been introduced by man into this country without any idea that it had ever previously trodden the soil of America. When Darwin discovered the bones of a fossil horse in South America, it was an unexpected revelation to science. But in this region of the Niobrara, no less than twelve distinct species of the horse have been found, ranging in size from that of the Newfoundland dog to that of the largest horse, thus seeming to prove this the true native land of the charger. Though all these animals have long since departed from the earth, their genera are still represented in most cases, but strangely enough most of these representatives are now only found in Asia and Africa.

In the cretaceous deposits are found leaves much more modern in character than those of the European chalk beds. For the flora of the European chalk is no longer represented on that continent, and its family relations connect it with Indo-Australian instead of modern European plants. It had thence become a maxim that the cretaceous period was entirely unrepresented in modern plants. But these American beds have quite overthrown this idea, yielding plants that closely conform to those now living. These plants are related to those found in European tertiary beds, showing that America was far ahead of Europe in its organic development, and has far better claims to the title of the Old World.

Testing Lubricating Oils---Invention wanted.

In an editorial upon this subject, the *National Oil Journal* remarks: Some practical and inexpensive method of testing the quality and relative value of different kinds of lubricating oils, is a standing want on the part of large oil consumers.

We know that some of our best railway managers comprehend the importance of this matter, and are anxious that some method should be devised which will secure them against the contingencies we have indicated. The Great Western railway company of Canada is the only one, so far as we are aware, that has undertaken a practical solution of the question At their machine shop, in the city of Hamilton, they have erected a very simple yet thoroughly practical machine for the purpose of testing lubricating oils. It consists of an ordinary car axle arranged to run in ordinary journal boxes. The axle is run by belts from a stationary engine at a uniform rate of speed, and under a pressure of 2½ tons to each journal—equivalent to ten tons to a car. The packing and all the other conditions of the test are made to correspond as nearly as possible to those of a car in motion on the road. A thermometer is so arranged as to indicate the exact temperature, and during a trial all the conditions of the test are recorded in what is called the test book. No oils are purchased nor allowed to be put on the road without being first tested by this machine.

It may not be inappropriate to give in this connection a brief description of a machine for a similar purpose, but of more elaborate construction, built a few years ago by the authorities at the Brooklyn Navy Yard. In this case the tests were designed to be analagous to the requirements for the main bearings of screw steamers. For this purpose a shaft with journals 9 inches in diameter was fitted to revolve in appropriate brasses. The upper brasses, instead of being secured by the usual caps, were weighted by a system of levers so arranged that the pressure could be graduated at pleasure and accurately measured. By running at a uniform rate of speed, with a counter attached to each shaft and a thermometer in each one of the upper brasses, they were able to keep an exact record of all the conditions of the tests. In operating the machine the pressure on the journals was gradually increased until the maximum that could be sustained without increasing the temperature above 116° Fahrenheit was ascertained. This maximum pressure, other conditions being equal, was taken as an index of the relative merits of the oils tested. It was found that by applying winter sperm oil at the rate of one half gallon in 25 hours, the journals would just stand a pressure of 9,400 pounds without increasing the temperature. Under the same conditions summer sperm was reported as standing a pressure of 11,164 pounds, and lard 8,000 pounds. The best grades of petroleum lubricators stood from 8,000 to 9,000, while the various inferior mixtures and compounds were represented by greatly reduced figures. It appears that the operators conducted all their experiments with uniform quantity of oil and a graduated pressure. We think they would have rendered their report far more valuable if they had varied the test, and added a table of results in running with a uniform pressure, and the quantity of oil graduated to the apparent requirements of the journals. A purchasing agent, with a machine of this kind adapted to this use, would be able not only to guard against annoyance and damage from inferior goods, but would be able to determine with far greater accuracy than at present, the relative value of the different grades of lubricators in the market. He could go to work intelligently to to find the true economic mean between high and low priced oils, and could determine for himself the quality and cost of oil adapted to his use. The Brooklyn machine complete cost but $412. We presume that one possessing all its advantages and adapted to railway purposes might be constructed for nearly or quite one half the money. But in our opinion they would be cheap at double or three times that sum, provided they could not be obtained for less. Will not some one possessed with a spirit of invention, go to work and construct and put on the market a portable machine which will meet all the requirements of the case?

The Art of Employing Time.

Adam Smith has shown, beyond all possibility of cavil, that a great many more pins can be made if the process is divided among eighteen trades, than if each workman is obliged to make every pin from beginning to end himself. So, too, a naturalist, who spends year after year in the observation of red ants, will be likely to learn far more of their nature and habits than could ever be known without making them the objects of special study. There is a story told of a learned German professor who had given his whole life to the study of the Greek article, and who on his deathbed, warned his son to learn from his example, and not to fritter away his time in trying to master too extensive a subject; for he himself had failed in that way, whereas he might have accomplished something if had confined his labors to the dative case. Now it is no mean thing to accomplish something, and there is a deep delight in knowing that a thing done has been done well. Perhaps one is happier if, by dint of patient grubbing for a lifetime, he finally gets to the bottom of one thing, than he would be if, like a swallow skimming over a thousand meadows, he had been merely sipping the manifold sweets of nature, even though he should have sipped of them all.

We would not speak too positively on this point for it is so easy to be wrong. But in so far as we may speak, we will declare our conviction that there is a higher ideal than exclusive devotion to a single end, and that more happiness and the best social results are attainable by an harmonious development of all our faculties, intellectual, moral, and æsthetic. We believe that a state of society is desirable, and we hope it is attainable, in which even the pointer of pins or the lowliest of workers will, in addition to his routine of work (for we do not expect or desire to see division of labor discarded), find both time and inclination to extend his thought over other fields. We feel that no man should, if he can help it, allow himself to be so absorbed in a single pursuit as to find no pleasure elsewhere, and thus dwarf the greater part of his nature. There is a joy in work, it is true, if work be performed with heart and strength; but there are innumerable other joys of nature, which present themselves at unexpected moments in unexpected ways, and must be grasped at once or they are gone forever.—*Exchange and Review.*

The Stevens Institute of Technology.

The late Edwin A Stevens, of Hoboken, N. J., a gentleman of rare intelligence and great wealth, provided by his will, among other benevolent dispositions of his property, for the establishment at Hoboken of a large and splendid institution of learning. He desired that it should be furnished with every possible appliance capable of affording assistance in thorough instruction in the sciences, that the fees for tuition should be moderate, and its usefulness thus widely extended.

Up to the present time the trustees have received from his estate the munificent sum of seven hundred and fifty thousand dollars. They have just completed a noble building in Hoboken, opposite New York, and it is stocked with perhaps the finest collection of scientific apparatus ever brought together.

The Stevens Institute of Technology opens its first session on the 20th of September next, with the following scale of tuition fees: Residents of New Jersey, $75 per annum; to others, $150.

The faculty, as will be seen from the advertisement in another column, embraces the names of some of our best and most eminent scientific instructors; Prof. Henry Morton, of Philadelphia, is the President, and under his enterprising and judicious lead the Stevens Institute will undoubtedly take a high rank.

Cheap Postage in England.

New and still cheaper rates of postage went into operation in England, August 1st. Letters and parcels of all sorts, closed or open, without any distinctions, are charged as follows:

Not exceeding 1 oz						2 cents.
Above	1 oz.	but not exceeding	2 oz.		3	"
"	2 oz.	"	"	4 "	4	"
"	4 oz.	"	"	6 "	5	"
"	6 oz.	"	"	8 "	6	"
"	8 oz.	"	"	10 "	7	"
"	10 oz.	"	"	12 "	8	"

12 ounces is the limit of weight for letters.

In this country, our rate for letter postage continues to be 3 cents for each half ounce, or six cents an ounce, which is just three times higher than the new English rate for an ounce, and nine times more than the English rate for twelve ounces.

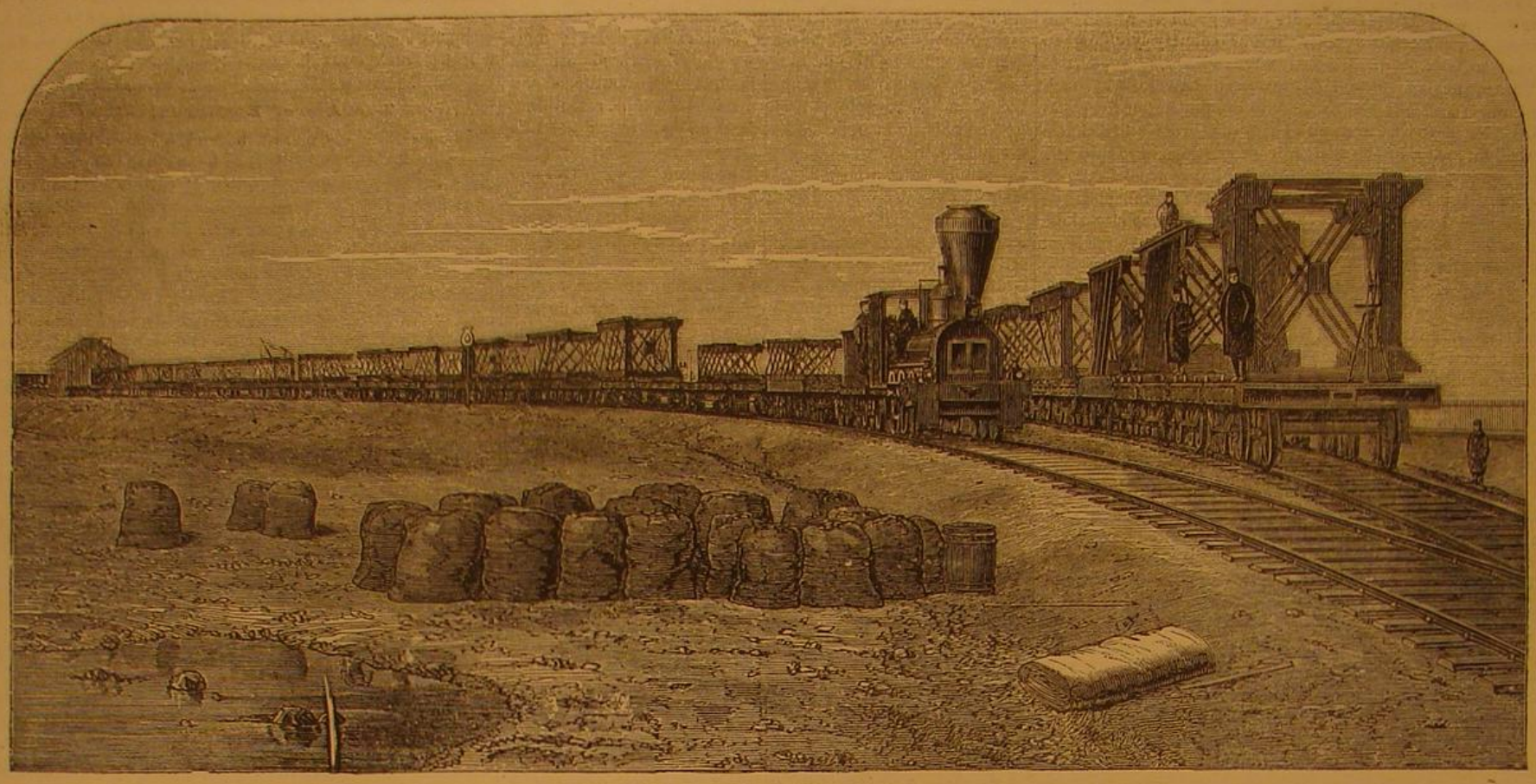
We think our Government might take a lesson from England in the matter of cheap letter postage. But for parcels of certain kinds, our rates are less than the British charges.

WROUGHT IRON BRIDGES FOR THE NICOLAI RAILWAY OF RUSSIA.

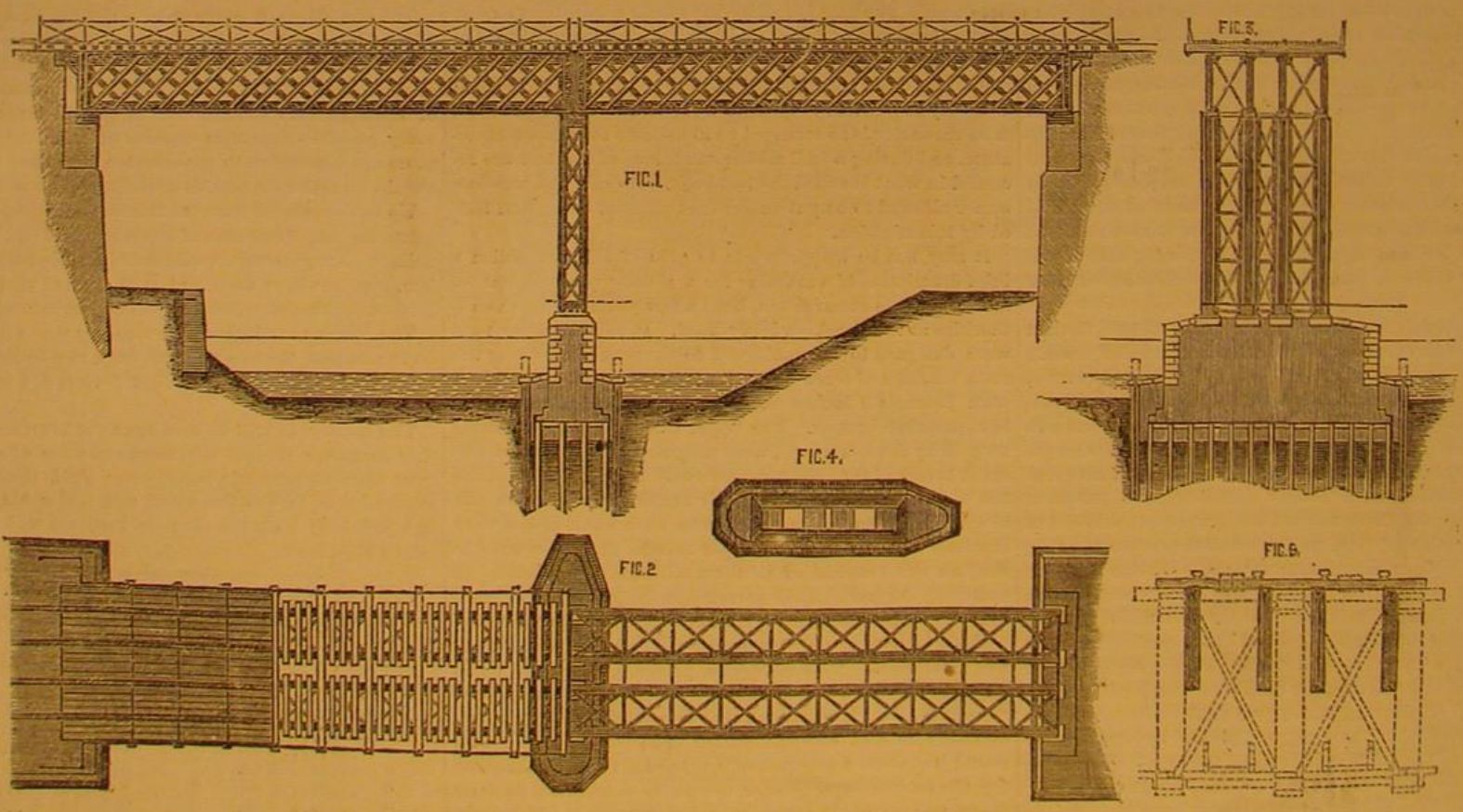
The largest of these bridges is that which carries the railway across the river Msta, and which consists of nine spans of 199 feet 6 inches each, center to center of piers; its total length, including abutments, is 1927 feet, 6 inches. Two spans of this bridge were destroyed by fire towards the close of 1869, but were reconstructed, and the through traffic was restored in the early part of 1870. The superstructure carries a roadway 31 feet 6 inches wide, and is formed of three lines of timber lattice girders 21 feet deep throughout their length, and they cross the river at a clear height of 101 feet 6 inches above the ordinary water level. The piers of the bridge are partly of timber and partly of brickwork and masonry. The bridge was constructed in 1849 from the designs of Major George W. Whistler, of the United States engineers, who was the engineer of the Nicolai railway. The Msta bridge is interesting as illustrating the class of bridges on this railway, which are gradually being superseded by iron structures, and which, sooner or later, will itself be replaced by one of a more permanent character.

It was this liability to destruction, both from fire and decay which formed an inherent element of danger in these bridges, that led to a determination several years since to replace them all by iron structures. The partial destruction of the Msta bridge probably hastened the conclusions on this point, for shortly after the accident it was decided to reconstruct all the other bridges, and tenders were invited from various European engineering firms for that purpose. Eventually Messrs. Andrew Handyside and Co., of Derby and London, obtained the contract for the supply and erection of seventeen of the bridges, with spans varying in width from 60 to 90 ft. The designs for these bridges were supplied by the Russian engineers, and they are all more or less copies of each other. We have illustrated herewith one of these bridges, for a double span, made from a working drawing by Messrs. Handyside & Co. In the engraving Fig. 1 is an elevation, Fig. 2 a plan, Fig. 3 a vertical tranverse section through the girders near the pier, and Fig. 4 a plan of the pier of the bridge, Fig. 5 being a transverse section or diagram showing the wooden structure, and it is illustrative of the method of building the new bridge into the old one. The total width of the opening is 143 feet, each girder—which is of the ordinary lattice type—being 74 feet in length, and 9 feet 2 inches in depth. The girders are riveted together over the centre of the pier, the ends resting on masonry abutments. There are four girders in each bridge, which are braced together in pairs by diagonal bracing, the two pairs being connected by tranverse tie bars, as seen from the plan of the bridge. The roadway is carried on the top of the girders upon transverse timbers, on which a longitudinal timber decking is laid, the width between the handrails being 24 feet. The piers consist of four built up wrought iron columns, square in plan, and which may be compared to box girders placed on end. The necessity for using wrought iron in these piers, as indeed in the whole of the superstructure, arises from the circumstance that cast iron is an objectionable material for the purpose on account of the extreme degree of cold to which it would be subject in a Russian winter. These columns are 30 feet high, and rest on a pier formed of masonry with a brick core, 16 feet high, and resting on 2 feet of concrete laid on piling. The height from bed of the river to the underside of the girders is 42 feet. The piers are built with cutwaters on the side facing the current as a protection against the floating ice, the dimensions of the piers being at their bases 37 feet 4½ inches long by 11 feet 6 inches wide.

The method of construction adopted by Messrs. Handyside was as follows: The ironwork was sent from England ready for riveting up, which was done at the St. Petersburgh end of the Nicolai Railway. A large space of ground adjoining the railway was granted them for a building yard, and there they established constructing sheds and appliances, a number of sidings being laid down for the work. Arrived at St. Petersburgh, the girders were built up on railway wagons—of which they had more than one hundred in use—in sections suited to the length of the wagons, which themselves were long, being carried on a pair of bogie frames. It is this point in the work of construction that the engraving represents, and which shows the building yard of Messrs. Handyside & Co., with the railway wagons on which the girders are being built up ready for removal down the line. As the work was finished, the wagons carried it to the site where it was to be used, the level nature of the railway, its freedom from sharp curves, and the absence of overhead bridges, rendering the line peculiarly suitable for this arrangement. Arrived at their destination, the trucks on one line of rails, and carrying one pair of girders, were run on to the bridge, and the girders lifted from off them by special tackle sent out from England. The wagons were then run back, and the girders were lowered into their required position, each girder coming almost directly in line of the rails as previously laid. By this arrangement, the traffic was only stopped on one line of rails at a time during reconstruction, the second pair of girders not being laid until the traffic could be carried on over the first pair. The timber of the old structure was then removed, the platform made good, and the bridge was again ready for traffic on both lines, the interruption of which was thus only partial and then of comparatively short duration.



METHOD OF CONSTRUCTING THE NICOLAI RAILWAY BRIDGES AT ST. PETERSBURGH, RUSSIA.



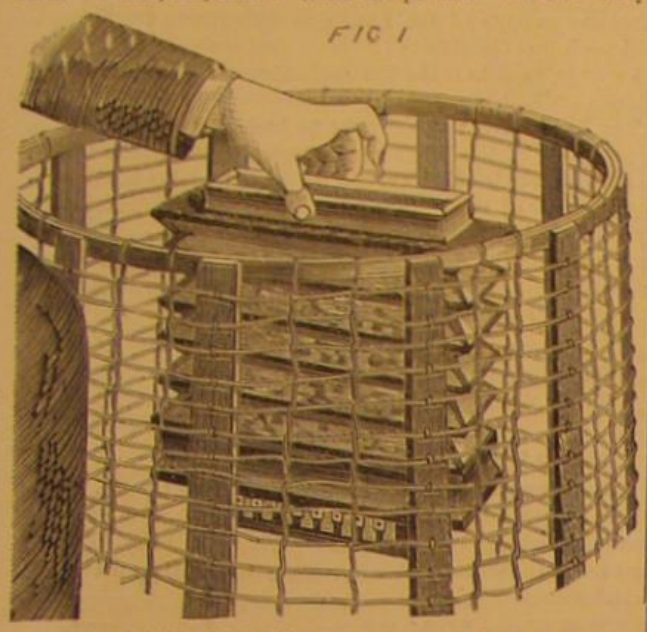
WROUGHT IRON BRIDGE FOR THE NICOLAI RAILWAY.

EXPERIMENTAL INVESTIGATION OF A NEW FORCE.

(By William Crookes, F. R. S., &c., to the Quarterly Journal of Science.)

Twelve months ago, in this journal, I wrote an article, in which, after expressing in the most emphatic manner my belief in the occurrence, under certain circumstances, of phenomena inexplicable by any known natural laws, I indicated several tests which men of science had a right to demand before giving credence to the genuineness of these phenomena. Among the tests pointed out were, that a "delicately poised balance should be moved under test conditions;" and that some exhibition of power equivalent to so many foot pounds, hould be "manifested in his laboratory, where the experimentalist could weigh, measure, and submit it to proper tests." I said, too, that I could not promise to enter fully

FIG 1



nto this subject, owing to the difficulties of obtaining opportunities, and the numerous failures attending the inquiry; moreover, that "the persons, in whose presence these phenomena take place, are few in number, and opportunities for experimenting with previously arranged apparatus are rarer still."

Opportunities having since offered for pursuing the investigation, I have gladly availed myself of them for applying to these phenomena careful scientific testing experiments, and I have thus arrived at certain definite results which I think it right should be published. These experiments appear conclusively to establish the existence of a new force, in some unknown manner connected with the human organization, which, for convenience, may be called the Psychic Force.

Of all the persons endowed with a powerful development of this Psychic Force, and who have been termed "mediums," upon quite another theory of its origin, Mr. Daniel Dunglas Home is the most remarkable, and it is mainly owing to the many opportunities I have had of carrying on my investigations in his presence that I am enabled to affirm so conclusively the existence of this force. Ths experiments I have tried have been very numerous, but owing to our imperfect knowledge of the conditions which favor or oppose the manifestations of this force, to the apparently capricious manner in which it is exerted, and in the fact that Mr. Home himself is subject to unaccountable ebbs and flows of the force, it has but seldom happened that a result obtained on one occasion could be subsequently confirmed and tested with apparatus specially contrived for the purpose.

Among the remarkable phenomena which occur under Mr Home's influence, the most striking, as well as the most easily tested with scientific accuracy, are—(1) the alteration in the weight of bodies, and (2) the playing of tunes upon musical instruments (generally an accordion, for convenience of portability) without direct human intervention, under conditions rendering contact or connection with the keys impossible. Not until I had witnessed these facts some half a dozen times, and scrutinized them with all the critical acumen I possess, did I become convinced of their objective reality. Still, desiring to place the matter beyond the shadow of a doubt, I invited Mr. Home on several occasions to come to my own house, where, in the presence of a few scientific inquirers, these phenomena could be submitted to crucial experiments.

The meetings took place in the evening, in a large room lighted by gas. The apparatus prepared for the purpose of testing the movements of the accordion, consisted of a cage, formed of two wooden hoops, respectively 1 foot 10 inches and 2 feet diameter, connected together by 12 narrow laths, each 1 foot 10 inches long, so as to form a drum shaped frame, open at the top and bottom; round this 50 yards of insulated copper wire were wound in 24 rounds, each being rather less than an inch from its neighbor. These horizontal strands of wire were then netted together firmly with string, so as to form meshes rather less than 2 inches long by 1 inch high. The height of this cage was such that it would just slip under my dining table, but be too close to the top to allow of the hand being introduced into the interior, or to admit of a foot being pushed underneath it. In another room were two Grove's cells, wires being led from them into the dining room, for connection if desirable with the wire surrounding the cage.

The accordion was a new one, having been purchased for these experiments at Wheatstone's, in Conduit street. Mr. Home had neither handled nor seen the instrument before the commencement of the test experiments.

In another part of the room an apparatus was fitted up for experimenting on the alteration of the weight of a body. It consisted of a mahogany board, 36 inches long by 9½ inches wide and 1 inch thick. At each end a strip of mahogany 1½ inches wide was screwed on, forming feet. One end of the board rested on a firm table, whilst the other end was supported by a spring balance hanging from a substantial tripod stand. The balance was fitted with a self-registering index, in such a manner that it would record the maximum weight indicated by the pointer. The apparatus was adjusted so that the mahogany board was horizontal, its foot resting flat on the support. In this position its weight was 3lbs., as marked by the pointer of the balance.

Before Mr. Home entered the room, the apparatus had been arranged in position, and he had not even had the object of some of it explained before sitting down. It may, perhaps, be worth while to add, for the purpose of anticipating some critical remarks which are likely to be made, that in the afternoon I called for Mr. Home at his apartments, and when there he suggested that as he had to change his dress, perhaps I should not object to continue our conversation in his bedroom. I am, therefore, enabled to state positively that no machinery, apparatus, or contrivance of any sort was secreted about his person.

The investigators present on the test occasion were an eminent physician, high in the ranks of the Royal Society, whom I will call Dr. A. B.; a well-known Serjeant at Law, whom I will call Serjeant C. D.; my brother; and my chemical assistant.

Mr. Home sat in a low easy chair at the side of the table. Close in front, under the table, was the aforesaid cage, one of his legs being on each side of it. I sat close to him on his left, and another observer sat close on his right, the rest of the party being seated at convenient distances round the table.

For the greater part of the evening, particularly when anything of importance was going forward, the observers on each side of Mr. Home kept their feet respectively on his feet, so as to be able to detect his least movement. The temperature of the room varied from 68° to 70° F.

Mr. Home took the accordion between the thumb and middle finger of one hand at the opposite end to the keys (see wood cut, Fig. 1), (to save repetition this will be subsequently called "in the usual manner.") Having previously opened the bass key myself, and the cage being drawn from under the table so as just to allow the accordion to be passed in-keys downwards, it was pushed back as close as Mr. Home's arm would permit, but without hiding his hand from those next to him (see Fig. 2). Very soon the accordion was seen by those on each sides to be waving about in a omewhat curi-

FIG. 2

ous manner; then sounds came from it, and finally several notes were played in succession. Whilst this was going on, my assistant got under the table, and reported that the accordion was expanding and contracting; at the same time it was seen that Mr. Home's hand which held it was quite still, his other hand resting on the table.

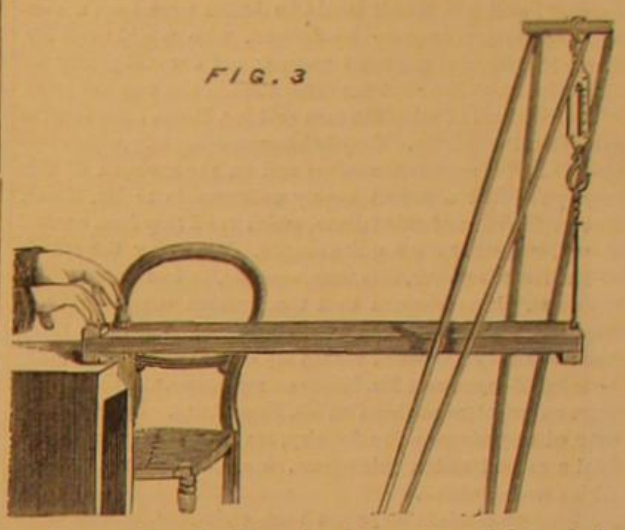
Presently the accordion was seen by those on either side of Mr. Home to move about, oscillating and going round and round the cage, and playing at the same time. Dr. A. B. now looked under the table, and said that Mr. Home's hand appeared quite still while the accordion was moving about emitting distinct sounds.

Mr. Home still holding the accordion in the usual manner in the cage, his feet being held by those next him, and his other hand resting on the table, we heard distinct and separate notes sounded in succession, and then a simple air was played. As such a result could only have been produced by the various keys of the instrument being acted upon in harmonious succession, this was considered by those present to be a crucial experiment. But the sequel was still more striking, for Mr. Home then actually let go the accordion, removed his hand quite out of the cage, and placed it in the hand of the person next to him, the instrument then continuing to play while no one was touching it.

I was now desirous of trying what would be the effect of passing the battery current round the insulated wire of the cage, and my assistant accordingly made the connection with the wires from the two Grove's cells. Mr. Home again held the instrument inside the cage in the same manner as before, when it immediately sounded and moved about vigorously. But whether the electric current passing round the cage assisted the manifestation of force inside, it is impossible to say.

The accordion was now again taken without any visible touch from Mr. Home's hand, which he removed from it entirely; I and two of the others present not only seeing his released hand, but the accordion also floating about with no visible support inside the cage. This was repeated a second time, after a short interval. Mr. Home presently reinserted his hand in the cage and again took hold of the accordion. It then commenced to play, at first chords and runs, and afterwards a well-known sweet and plaintive melody, which it executed perfectly in a very beautiful manner. Whilst this tune was being played, I took hold of Mr. Home's arm, below

FIG. 3



the elbow, and gently slid my hand down it until I touched the top of the accordion. He was not moving a muscle. His other hand was on the table, visible to all, and his feet were under the feet of those next to him.

Having met with such striking results in the experiments with the accordion in the cage, we turned to the balance apparatus already described. Mr. Home placed the tips of his fingers lightly on the extreme end of the mahogany board which was resting on the support, while Dr. A. B. and myself sat one on each side of it, watching for any effect which might be produced. Almost immediately the pointer of the balance was seen to descend. After a few seconds it rose again. This movement was repeated several times, as if by successive waves of the Psychic force. The end of the board was observed to oscillate slowly up and down during the time.

Mr. Home now of his own accord took a small hand bell and a little card match box, which happened to be near, and placed one under each hand, to satisfy us, as he said, that he was not producing the downward pressure (see Fig. 3). The very slow oscillation of the spring balance became more marked, and Dr. A. B., on watching the index, said that he saw it descend to 6½ lbs. The normal weight of the board as so suspended being 3 lbs., the additional downward pull was therefore 3½ lbs. On looking immediately afterwards at the automatic register, we saw that the index had at one time descended as low as 9 lbs., showing a maximum pull of 6 lbs.

In order to see whether it was possible to produce much effect on the spring balance by pressure at the place where Mr. Home's fingers had been, I stepped upon the table and stood on one foot at the end of the board. Dr. A. B., who was observing the index of the balance, said that the whole weight of my body, (140 lbs.) so applied, only sunk the index 1½ or 2 lbs. when I jerked up and down. Mr. Home had been sitting in a low easy-chair, and could not, therefore, had he tried his utmost, have exerted any material influence on these results. I need scarcely add that his feet as well as his hands were closely watched by all in the room.

This experiment to me appears, if possible, more striking than the one with the accordion. As will be seen on referring to the cut (Fig. 3), the board was arranged perfectly horizontally, and it was particularly noticed that Mr. Home's fingers were not at any time advanced more than 1½ inches from the extreme end, as shown by a pencil mark, which, with Dr. A. B.'s acquiescence, I made at the time. Now, the wooden foot being also 1½ inches wide, and resting flat on the table, it is evident that no amount of pressure exerted within this space of 1½ inches could produce any action on the balance. Again, it is also evident that when the end furthest from Mr. Home sank, the board would turn on the further edge of this foot as on a fulcrum. The arrangement was consequently that of a see-saw, 36 inches in length, the fulcrum being 1½ inches from one end; were he, therefore, to have exerted a downward pressure, it would have been in opposition to the force which was causing the other end of the board to move down.

The slight downward pressure shown by the balance when I stood on the board was owing probably to my foot extending beyond this fulcrum.

I have now given a plain unvarnished statement of the facts from copious notes written at the time the occurrences

were taking place, and copied out in full immediately after. Indeed, it would be fatal to the object I have in view—that of urging the scientific investigation of these phenomena—were I to exaggerate ever so little; for although to my readers Dr. A. B. is at present represented by incorporeal initials, to me the letters represent a power in the scientific world that would certainly convict me if I were to prove an untrustworthy narrator.

I confess I am surprised and pained at the timidity or apathy shown by scientific men in reference to this subject. Some little time ago, when an opportunity was first presented to me of examining into the subject, I invited the co-operation of some scientific friends in systematic investigation; but I soon found out that to obtain a scientific committee for the investigation of this class of facts was out of the question, and that I must be content to rely on my own endeavors aided by the co-operation from time to time of the few scientific and learned friends who were willing to join in the inquiry. I still feel that it would be better were such a committee of known men to be formed, who would meet Mr. Home in a fair and unbiased manner, and I would gladly assist in its formation; but the difficulties in the way are great.

A committee of scientific men met Mr. Home some months ago at St. Petersburg. They had one meeting only, which was attended with negative results; and on the strength of this they published a report highly unfavorable to Mr. Home. The explanation of this failure, *which is all they have accused him of*, appears to me quite simple. Whatever the nature of Mr. Home's power, it is very variable, and at times entirely absent. It is obvious that the Russian experiment was tried when this force was at a minimum. The same thing has frequently happened within my own experience. A party of scientific men met Mr. Home at my house, and the results were as negative as those at St. Petersburg. Instead, however, of throwing up the inquiry, we patiently repeated the trial a second and a third time, when we met with results which were positive.

These conclusions have not been arrived at hastily or on insufficient evidence. Although space will allow only the publication of the details of one trial, it must be clearly understood that for some time past I have been making similar experiments and with like results. The meeting on the occasion here described was for the purpose of confirming previous observations by the application of crucial tests, with carefully arranged apparatus, and in the presence of irreproachable witnesses.

Respecting the causes of these phenomena, the nature of the force to which, to avoid periphrasis, I have ventured to give the name of "Psychic," and the correlation existing between that and the other forces of Nature, it would be wrong to hazard the most vague hypothesis. Indeed, in inquiries connected so intimately with rare physiological and psychological conditions, it is the duty of the inquirer to abstain altogether from framing theories until he has accumulated a sufficient number of facts to form a substantial basis upon which to reason. In the presence of strange phenomena as yet unexplored and unexplained, following each other in such rapid succession, I confess it is difficult to avoid clothing their record in language of a sensational character. But to be successful, an inquiry of this kind must be undertaken by the philosopher without prejudice and without sentiment. Romantic and superstitious ideas should be entirely banished, and the steps of his investigation should be guided by intellect as cold and passionless as the instrument he uses. Having once satisfied himself that he is on the track of a new truth, that single object should animate him to pursue it, without regarding whether the facts which occur before his eyes are "naturally possible or impossible."

Experimental Investigation of the New Force.—Letters from Prof. Huggins and Edwd. Wm. Cox.

Upper Tulse-hill, S. W., June 9, 1871.

DEAR MR. CROOKES:—Your proof appears to me to contain a correct statement of what took place in my presence at your house. My position at the table did not permit me to be a witness to the withdrawal of Mr. Home's hand from the accordion, but such was stated to be the case at the time by yourself, and by the person sitting on the other side of Mr. Home.

The experiments appear to me to show the importance of further investigation, but I wish it to be understood that I express no opinion as to the cause of the phenomena that took place. Yours very truly, WILLIAM HUGGINS.

Wm. Crookes, Esq., F.R.S.

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36 Russell Square, June 8, 1871.

MY DEAR SIR:—Having been present, for the purpose of scrutiny, at the trial of the experiments reported in the *Quarterly Journal of Science*, I readily bear my testimony to the perfect accuracy of your description of them, and to the care and caution with which the various crucial tests were applied.

The results appear to me conclusively to establish the important fact that there is a force proceeding from the nerve system capable of imparting motion and weight to solid bodies within the sphere of its influence.

I noticed that the force was exhibited in tremulous pulsations, and not in the form of steady continuous pressure, the indicator moving and falling incessantly throughout the experiment. This fact seems to me of great significance, as tending to confirm the opinion that assigns its source to the nerve organization, and it goes far to establish Dr. Richardson's important discovery of a nerve atmosphere of various intensity enveloping the human structure.

Your experiments completely confirm the conclusion at which the Investigation Committee of the Dialectical Society arrives, after more than forty meetings for trial and test.

Allow me to add that I can find no evidence even tending to prove that this force is other than a force proceeding from, or directly dependent upon, the human organization, and therefore, like all other forces of nature, wholly within the province of that strictly scientific investigation to which you have been the first to subject it.

Psychology is a branch of science as yet almost entirely unexplored, and to the neglect of it is probably to be attributed the seemingly strange fact that the existence of this nerve force should have so long remained untested, unexamined, and almost unrecognized.

Now that it is proved by mechanical tests to be a fact in nature (and if a fact, it is impossible to exaggerate its importance to physiology and the light it must throw upon the obscure laws of life, of mind, and the science of medicine) it cannot fail to command the immediate and most earnest examination and discussion by physiologists and by all who take an interest in that knowledge of "man," which has been truly termed "the noblest study of mankind." To avoid the appearance of any foregone conclusion, I would recommend the adoption of some appropriate name, and I venture to suggest that the force be termed the Psychic force; the persons in whom it is manifested, Psychics; and the science relating to it, Psychism, as being a branch of Psychology.

Permit me also to propose the early formation of a Psychological society, purposely for the promotion of the study by means of experiment, papers, and discussion, of that hitherto neglected science. I am, etc., EDWD. WM. COX.

To W. Crookes, Esq., F.R.S.

Correspondence.

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

Constructing Cone Pulleys.

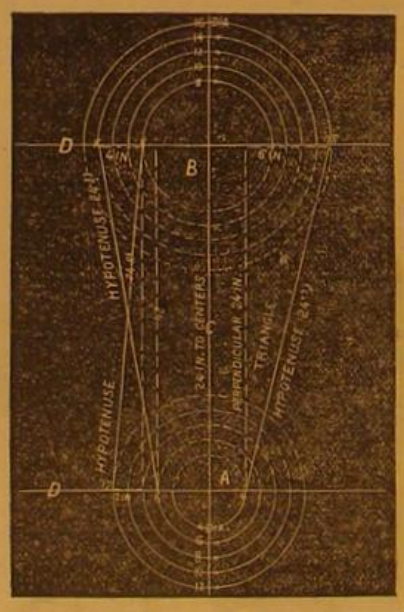
To the Editor of the Scientific American:

Thinking that G. L. D., of Pa., has misunderstood H. G. L.'s problem (in No. 1, July 1), which is to construct a pair of cone pulleys so that the belt will fit equally tight on all the steps, I venture to give a rule, only, however, an approximate one.

I send, that I may be more fully understood, a diagram, which is purposely an extreme case, to show all the errors there may be in it. I will give my method somewhat in detail.

Procure a draft board of sufficient length to draw the cones full size and the full distance they are to be apart when put up, as cones can be made to match at only one distance.

Referring to the diagram, draw cone, A, as wanted when finished (I have marked five pulleys, 4, 6, 8, 10 and 12 inches as their diameters); and cone, B, with the same difference



(between pulleys) that there is on cone, A, but different in diameters, which are 8, 10, 12, 14, 16 inches, respectively.

Draw the line, C, joining the centers of cones 24 inches distant; also, lines, D, at right angles to line, C.

Now, as cone, A, is finished, as wanted, all the correcting must be done on cone, B; and as there is a 10 inch on each, and so they will require no changing, we will consider them correct, because the belt runs parallel with the center line and round half of each pulley, establishing the length of belt, which is twice the distance the centers of cones are apart, and an amount equal to the circumference of a ten inch pulley. Thus:

Distance to center line, 24×2	48·00
Circumference of 10 inch pulley	31·41
Entire length of belt	79·41

I will now make the correction for 12 inches on A and 8 inches on B, which are a little different.

The line joining the 12 inch and 8 inch pulleys makes a triangle, base 2 inches; perpendicular 24 inches; hypotenuse $24\frac{8}{100}$; but the reducing the diameter of the 8 inch pulley increased the angle, while the other decreased the angle, and so a different fraction must be used. Multiply the fraction $\frac{8}{100}$ by 4 and ÷ by 3, and we get the fraction $\frac{10}{100}$. Reducing the 8 inch pulley by this fraction, we have $7\frac{90}{100}$ for the diameter; this changes the triangle, and we have for short side $2\frac{5}{100}$, long side 24, and hypotenuse $24\frac{3}{100}$.

And we have for this second measurement:

Half diameter of $7\frac{9}{100}$ inch pulley	12·40
Half diameter of 12 inch pulley	18·84
Twice the hypotenuse, $24\frac{3}{100}$	48·18
	79·42

This is the $\frac{1}{100}$ of an inch longer than the belt for the 10 inch pulleys; and the greatest error is in the 4 inch pulley and 16 inch pulley, the error being $\frac{15}{100}$, or about $\frac{1}{7}$ of an inch. Now, to apply this in practice, draw the pulleys full size and full distance apart, on a draft board; get the distance correctly on straight edge from center to center of cones. Finish up one cone as desired, or as drawn on draft board; now try your straight edge on the hypotenuse, and the amount the hypotenuse is longer than the distance from centers is the amount the pulley must be reduced in diameter, unless the reducing the diameter increases the hypotenuse; in such a case the amount the hypotenuse is greater than a straight line, *b*, must be multiplied by 4 and divided by 3, and the diameter of pulley reduced by the product.

You will perceive that it makes no difference whether there are pulleys of the same size on each or not, the rule will work just the same.

I now proceed to make the correction for the 4 inch and 16 inch pulleys.

The line joining the circles at 14 inch and 16 inch is the hypotenuse of the right angle triangle, with base 6 inch and perpendicular 24 inch, and hypotenuse $24\frac{13}{100}$. Reduce the diameter of the 16 inch pulley by $\frac{13}{100}$, the amount the hypotenuse is longer than the perpendicular, and the 16 inch pulley will be $15\frac{87}{100}$ inch, and the short side of the triangle is $54\frac{64}{100}$, long side 24 inch, hypotenuse, $24\frac{65}{100}$.

This second measurement is thus stated:

Half circumference $15\frac{87}{100}$ inch pulley	23·98
Half circumference 4 inch pulley	6·28
Twice the hypotenuse, $24\frac{65}{100}$	49·30
Length of belt, nearly	79·56

But it may be noticed that the belt would strike the 16 inch pulley before reaching the center line, bending the belt out considerably; and in such a case, if we call the $\frac{13}{100}$, $\frac{14}{100}$, and make the calculation accordingly we shall be nearer correct. This would be:

Hypotenuse, $24\frac{57}{100}\times 2$	49·14
Half circumference large pulley	23·93
Half circumference small pulley	6·28
	79·35

The next I will correct are the 6 inch and 14 inch pulleys. The line joining 6 and 14 makes the triangle 4 inch and 24 inch, hypotenuse $24\frac{33}{100}$. This is the first measurement. Now reduce the 14 inch pulley $\frac{33}{100}$, the amount by which the hypotenuse is longer than the perpendicular. Now we have for the 14 inch pulley $13\frac{67}{100}$ diameter, and the short side of the triangle, $3\frac{84}{100}$; long side, 24, and hypotenuse, $24\frac{30}{100}$. This is the second measurement, and may be thus expressed:

Half circumference of $13\frac{67}{100}$ inch pulley	21·47
Half circumference 6 inch pulley	9·42
Twice the hypotenuse, $24\frac{30}{100}$	48·60
Length of belt for this pair	79·49

La Grange, Ind. J. TURLEY.

The Paine Electro Magnetic Engine—Curious Revelations by a Practical Man.

To the Editor of the Scientific American:

In forming an opinion of the Paine motor, several points should be considered, and compared with one another. These are, the construction and appearance of the motor, its operation, its surroundings, the fizzle of engines modeled after it, and Mr. Paine's variegated statements.

The general appearance of this motor is that of a fan blower some 2½ feet in diameter. The cast iron shell or frame supports five stationary magnets, with their poles pointing towards the center. Corresponding to the fans of a blower are six rotary magnets, with their poles pointing outward. There is a system of circuits running around the frame to which the rotating magnets are fastened—one circuit for each magnet. The shell hides something like half of both sets of magnets—the half including the poles. The base is also cast iron, evidently a shell, without so much as a pin hole through which one may look, and this base sits flat on the floor. In the same building is machinery run by steam.

The battery consists of 4 cells, about 8 inches high—zinc in dilute sulphuric acid, and carbon in chromic acid.

Mr. Paine holds that "the world knows nothing of the mechanical equivalent of zinc under combustion in a battery;" that "the forces developed by the action of a single Bunsen cell, if utilized and converted into power, would drive the largest ship afloat."

Here he recognizes an immense force as resident in a galvanic battery. Before setting his engine in motion the day I saw it, Mr. Paine explained its construction and operation, claiming success mainly on the ground of the utilization of the electric current, but 10 or 15 minutes afterwards he upset this statement by declaring that the force which ran his engine did not come from the battery; that the battery was a mere percussion torch or match, which *touched off some other power!*

Mr. Paine's explanation of the increased speed of his motor while performing hard work does not bear inspection. If, as he says, a reduced speed affords the magnets more time to charge and spring towards each other, then, of course, a greater velocity must give them less time to charge and let them spring back, again lessening their power; so this continual struggle to accelerate and retard should result in an apparently uniform motion.

On the occasion above mentioned, this engine made six revolutions per second, which put the revolving magnets into

ecuit 30 times a second and the stationary ones 36 times. Now, when we remember that the much smaller and quicker tegraph magnets can no more than half charge six times p second, it is difficult to believe that those in this engine quire, in the 70th part of a second, a power so enormous as topring the stout cast iron frame.

saw one freak in the Paine motor which seems explicable on on the theory that the battery "touches off some other poer." Four cells of battery would start the engine very sudenly, and run it with 2¼ or 3 horse power, but it stubbody refused to move by the current from 3 cells, even whe started by hand, though the galvanometer in circuit andhe spark at the commutator showed the proper amount of crrent. The connection was several times shifted from 3 to cells, and *vice versâ*, with this uniform result. Ohm's law which is a law as conclusively demonstrated as any that an be named) declares this force to be illegitimate.

Shetly after this freak, 4 cells failed to move the engine, thoug the battery was still good. I did not remain until the trable was remedied, but I was afterwards informed by a perso pecuniarily interested that Mr. Paine found defective insulaon in some of the connecting wires so that the current ws diverted from the magnets. This explanation might be acceted if it were not for that quiet little tell-tale, the spark s the commutator, as the engine was turned by hand. This spk is produced principally by the current induced by the ischarge of the magnets. Now, as this spark was not dimished by the trouble in question, it proves conclusively tht the same magnetic forces were in operation, and that thecurrent went its usual route. It is rather an unfortunate cincidence that Mr. Paine had occasion to leave the room fora few minutes just after the engine gave out.

Last wnter several enterprising gentlemen in New York and vicisty made such arrangements with Mr. Paine that if he coul have come to time, a score or more of successful Paine motrs would, ere this, have proved to the world what no man ever can on paper. These gentlemen, or some of them, required other proof than what they witnessed in Newark, so M. Paine promised to take his engine over to New York and let it run the machinery in the manufactory of one of these gentlemen, but he afterwards refused to do so. Then it was agred that one of these engines should be constructed in New York, Mr. Paine promising that if there was any difficulty in mating it a success he would come over and right it. Two small motors were then made—one with 9 magnets, the other with 11. No particular mention will be made of the former, because the latter gave the best results. The magnets in this were about 3 inches long, and averaged about 1 inch in width. I think they were wound with No. 23 wire, butam not positive now.

This engine was very carefully constructed and adjusted, and exhaustive experiments were made with it. The greatest speed attained by the use of 6 eight inch cells of bichromate battery was 10 revolutions per second. On the shaft of the rotary magnets was a smooth 2¼ inch pulley. By holding the blade of a penknife on the pulley, as if grinding, the speed was easily reduced from 10 revolutions per second to zero; yet Mr. Paine has admitted that engine to be correct!

Then the same parties constructed another motor, a trifle larger than the one exhibited in Newark. The magnets in this (6 rotary and 5 fixed) were wound with No. 16 wire. The greatest speed made by it was 110 revolutions per minute on the current from eight 8 inch cells of bichromate battery. The power of this engine was but a little greater than that of the small one, as a penknife held on the pulley would almost stop it. The Newark engine ran on 4 similar cells, and the current from them was reduced at least one half by the galvanometer in circuit, so we have this comparison; the Newark engine was 3 horse power on 2 cells, while the duplicate, using 8 cells, furnished just about enough power to grind a razor.

Mr. Paine was advised of the result, but he did not come to the rescue as promised. He did, however, send a substitute, with information that the magnets must be made of a certain size given, that required by the English patent (which was held to be a correct guide), and that of the magnets in the Newark engine being all at variance with one another. The mention of these inconsistencies to the substitute, cornered him; so, heaving a sigh, he departed, and Mr. Paine turned his attention to other parties.

After having put these gentlemen to the trouble and expense of building three engines, after having claimed that his English patent was a perfect guide, and having admitted that one of the engines built by them was correct, Mr. Paine then said he had given no clue to his success, and had not intended to; that the world was not yet prepared for the revelation; that it was so simple they would laugh when they learned what it was.

Six months ago the Paine motor was a perfect success. Now, according to the apologist, Mr. Sims, Mr. Paine merely hopes to succeed, and that, instead of laughing at the simplicity of his invention, he is "baffled" by it!

When will Mr. Paine and his associates learn that they cannot conceal themselves by thrusting their heads into a bush? J. E. SMITH.

Easton, Pa.

Formation of Gold Nuggets.

To the Editor of the Scientific American:

Mr. C. Wilkinson, of Australia, announces, to the Royal Society of Victoria, some experiments instituted by him, which Mr. Daintree assumes will account for the formation of gold nuggets.

Mr. W. Skey has also communicated to the Wellington Philosophical Society of New Zealand, a number of experiments upon the same subject. Having no desire to detract in any way from the merits of the labor of those gentlemen, it must be remembered that others have contributed much knowledge on the same subject.

The discovery of laws which regulate chemical energy is the result of pure experimental inquiry, and is often the result of the combined labors of many illustrious men. For the benefit of those who are likely to pursue that subject, it will be necessary to call the attention to some facts that have come under my own observation.

It will be seen that Mr. Wilkinson conducts his experiments by using a solution of gold undergoing decomposition by contact with organic matter. Gold is deposited upon itself. He also observes that some of the other metals and their sulphides act as a nucleus for gold thus reduced. Mr. W. Skey, pursuing the same subject, is surprised to find that the same effect takes place without the intervention of organic matter, the proto-salts and the sulphides effecting a direct reduction.

The question here arises, what new ideas have been advanced by the experiments above reported?

Depositing gold upon itself, as on other metals, is certainly no new feature. Chemistry has long been aware of such actions, their electro-negative qualities, and their behaviour among themselves. Mr. Skey is surprised to find gold deposited upon cubes of galena, and many of the sulphides. If Mr. Skey had pursued the matter a little further, he would have found that it was not necessary that it should be a metal, or its combination with sulphur, to form a nucleus to determine a deposit of gold. He would have found that graphite and many other substances act in the same manner. Again, he ought not to have been surprised to find gold depositing from its solution, in presence of a powerful deoxidizer. Such chemical actions have been long known, and are daily verified in the chemical arts. Brown iron ore and quartz appear to be unsuitable material to recover a deposit of gold.

It is evident that if gold had been deposited from its solutions, Nature must have employed other means to effect its purpose than the one chosen by our experimentalist, since gold is found disseminated and deposited upon quartz and the brown iron ore.

The question as to the formation of gold nuggets is a difficult one, and should be discussed with caution.

J. TUNBRIDGE.

Newark, N. J.

A Scientific Paradox.

To the Editor of the Scientific American:

It is held by some writers, that iron expands in passing from the molten to the solid state.

If this were true, it would account for the fact that cold iron will float in molten iron, by the difference in specific gravity.

But as a matter of fact, we find that it floats not on account but in spite of the difference; for we find that patterns for iron castings are made by the shrink rule, which is longer than the standard measure, by a little more than one per cent., while the castings made from such patterns correspond with the standard measure.

Other proofs in abundance might be cited, but the whole case is included in this, which demonstrates, too clearly to admit of question, that iron contracts in cooling, like other metals, and does not expand at all, as the books say; for the pattern is of the very magnitude of the molten iron in which the cold iron of the casting will float.

Various lame attempts have been made to patch up a reconciliation of the facts, by supposing an expansion and a subsequent greater contraction; but no proof is required to convince a rational mind that the only terms admissible in the computation, are the respective specific gravities of the hot and cold iron at the moment when the phenomenon takes place; and they cannot but be proportionate to the magnitude of the pattern and its casting. But even if the change of magnitude were in the right direction, it could only account for a part of the buoyancy of the cold iron, leaving a remainder quite as hard to account for as the whole; for the proportional part of the cold iron which rises above the surface is much greater than any change of its magnitude caused by heat.

Any person may find all the facts which I have stated fully confirmed, and a good many more added to them, by visiting a foundery at casting time; and if he will carefully weigh the facts as they are, and give a rational solution of the paradox, he will enjoy the satisfaction, I think, of having made an original contribution to scientific knowledge. S. H. W.

Deep River, Conn.

Use of Air Blasts in the Arts.

To the Editor of the Scientific American:

Will you permit the correction of some remarks (in your paper of July 29, page 72, entitled "Application of Air Blasts in the Arts"), which are apt to mislead your readers into the error that connects access of air to alcoholic liquids with acetic acidification?

The process of air treatment of R. d'Heureuse, of New York, to which you allude, secures a rapid, perfect, and safe alcoholic fermentation, free from acidification, at the temperature most suitable for that process; and, at the same time, a removal of the albuminous matter, which, if retained, impairs the taste, and produces future disturbances, in wine and other beverages.

It is not assumed that a few hours would accomplish this object in wine making; but less than one hour's vigorous blast, previous to, and occasional very brief and gentle admission of the air during, the fermentation, finishes this process in from 5 to 10 days, to make the wine ready for bottling, shipping, or consumption within from 1 to 3 months.

It has indeed been proved, that wine made by judicious air treatment has invariably less acid than wine from the same must, made in the usual most careful manner ("Annals of Oenology," vol. i., pp. 218, 428; vol. ii., p. 188; and *Journal of Applied Chemistry*, March and April, 1871).

The recent researches of many distinguished European investigators throw much light upon this subject. Dr. M. Reess found that the alcoholic fermentation is due solely to the presence of a distinct class of fungi (species of moving air *ces*), and to no others, and that liberal supply of *Saccharomy* vastly promotes their growth, while all other kinds of fungi, present in the fluid, are thereby suppressed; and that an alcoholic fermentation by air treatment is for this reason perfectly healthy, very energetic and rapid; and all putrefying or souring disturbances, incident to the usual mode of fermentation, as the results of injurious fungi, are prevented.

A few hours vigorous blast into organic juices or liquids at a temperature above 140° Fah., removes the albuminous parts, with suppression of fermentation. Articles in your valuable paper of June 17, August 7 and 14, 1869, and February 25, 1871, are explanatory of this action, and mention the advantages of this method for sugar making and refining, for the purification of drinking water from injurious organic matter, etc. The fact has also been established, that vegetable acids are neutralized (not formed) by vigorous blasts of air, or other gases, into the liquids that contain them, and particularly at a temperature of 160° and upwards, with the simultaneous removal of the albuminous parts. This action makes the process of superior value in sugar making and other businesses, where the greatest losses, by the usual modes of working, are due to souring and fermentation.

The real conditions productive of acetic acidification are still somewhat misunderstood by the general public. The same particles of (diluted) alcoholic liquids exposed in thin strata to a lengthy contact with air, for instance, by spreading over the rough surfaces of wood, shavings, etc., or the surface of a quiescent fluid, increased by scums, floating matter, or fungi, exposed to the contact, are subject to acetic acidification, which is prevented by currents of air through the bulk of the fluid. A powerful continued blast of air through such liquid, even where souring has already been induced, only carries off the acetic acid and the alcohol. According to the testimony of hundreds of wine makers that used air treatment, no acetic acidification was induced by the same. CHEMICUS.

New York city.

Electro-Motors.—Mr. Paine's Answer to Mr. J. E. Smith.

To the Editor of the Scientific American:

Mr. Smith must not assume that I have said that a magnet of the dimensions specified in my article, when actuated by the specified battery, acquires its *maximum* of attraction in the $\frac{1}{120}$ of a second of time. My words are: "It will acquire a *lifting power of fifty pounds* in the $\frac{1}{120}$ of a second;" and this statement is not predicated of any theoretic data, but of practical manipulation. Mr. Smith's reference to experiments in the *Telegraph* office is peculiarly unfortunate for the force of his argument, inasmuch as the electrical pulsations are made through *long circuits*.

I protest against these men of straw that my opponents set up, and then, so satisfactorily to themselves, demolish. My article in your journal of August 5th is a full answer to the rest of Mr. Smith's statements, as far as they relate to the question at issue. And I desire Mr. Smith and all others to bear in mind that I am not discussing my motor nor any of its qualities; but in a plain practical manner proving that the books and schools know nothing whatever of the mechanical equivalent of zinc when under combustion in a battery. H. M. PAINE.

NOTE.—Mr. Smith proposes, in a future communication, to relate his "experience in experimenting with three others, modeled after it," meaning, after my motor. I beg to say that unless Mr. Smith has had access to the secret archives of the Patent Office, he has not the knowledge required to produce a model of my motor.—H. M. P.

New Mechanical Movement.

To the Editor of the Scientific American:

The crossed link, converting circular into rectilinear movement, or, certainly, the reverse, converting rectilinear into circular movement by means of crossed links, is not so new as you and our patent authorities seem to have determined. Seven or eight and twenty years ago there existed in the *Sun* printing vaults, corner of Nassau and Fulton streets, a steam engine, placed there for temporary use only, called the "Grasshopper," because of a fancied resemblance to that well known insect. The peculiarity of this engine was this very principle of crossed links, and I now attribute its disappearance from the market to the death of its builder—a man of very limited means, but of much ingenuity.

A still more complete exemplification of the principle came under my observation at Paris some five or six years ago. It was in use in a confectionery establishment in the Rue Vivienne, not far from the Bourse, in a steam engine of some three horse power, the daintiness of whose construction was almost marvelous.

Mr. Russell's application of it to the pump, as described and illustrated in the SCIENTIFIC AMERICAN of July 29, 1871, is, however, the first application of it which I have observed in hand implements, and is an extremely ingenious one. B.

THE Weed Sewing Machine Company have leased the entire works of the Sharpe's Rifle Company, at Hartford, for five years, and will soon increase their daily manufacturing capacity from 150 to 200 machines.

The First Locomotive Works in America.

Scribner's Monthly for July, in describing Philadelphia and its industries, gives the following account of Baldwin's locomotive works:

The Baldwin Locomotive Works on Broad street have a national reputation. Founded in 1831, they have grown to colossal proportions, and employ 1,800 men. It takes 1,800 men one day to complete, set up, and make ready for service a single locomotive. Thus these works could turn out 300 engines a year; in fact, in twelve months, ending last October, they actually sent off 267, which, one after another, went dashing over the country. Although Mr. Baldwin, the founder, is dead, the works still bear his name, for they are the creation of his inventive genius and indomitable perseverance.

Previous to the spring of 1831, only two locomotives had been built in this country, and those at the National foundery of West Point. In that spring Mr. Baldwin made a miniature engine, with two cars, capable of seating four persons, and placed it on a track laid in Peale's Museum, where it was surrounded by curious crowds. The next year he received an order from the Germantown Railroad Company for the construction of a locomotive for their road. Although but a single American mechanic had succeeded in building one of any use, he boldly undertook it. At the time there was not a blacksmith in the city that could weld a bar of iron more than an inch and a quarter thick, and no one thought of attempting to weld a tire five inches wide and an inch and a half thick. The only machine for boring out a cylinder was a chisel fastened in the end of a stick, to which a crank was fitted and turned by hand. He had no proper tools, no patterns, no models, but, confidently relying on his genius and re-olution, he went to work, and in six months had it finished and placed on the road. Crowds gathered along the line to see this self moving monster drag a train of cars after it. It was a great success. Soon after there appeared in the city papers the following notice:

"NOTICE.—The engine (built by Mr. Baldwin) with a train of cars will run daily (commencing this day) when the weather is fair . . When the weather is not fair, the horses will draw the cars the four trips."

It is not yet forty years since this extraordinary notice appeared in the press of a city into which, now, a dozen railroads run, along which dozens of locomotives thunder.

It is singular how the simplest contrivances are often overlooked, while those requiring the most consummate skill are wrought out. Here was a man who could, almost without tools, from his own ingenious brain construct a locomotive, and yet the simple remedy of a "sand box," to keep the wheels from slipping never occurred to him. The principle he doubtless had seen applied a score of times to keep the human foot from slipping on the ice, but he never thought of adapting it to this case, and so in wet weather the locomotive was stabled and the horses turned out, and *vice versâ* in fair weather.

From that time the reputation of the works was established, until now it is doubtful if they have their equal in the world. A stroll through them awakens novel and often sublime emotions. Amid the din and clatter and thunder of machinery and ponderous hammers, the law of order is seen to prevail over all. Each part is made in a separate building or room, and one sees only a pile of rivets here, boilers there heaps of smoke stacks, and a confused collection of wheels and tires that resemble chaos. But at a given word these detached bones of the monster move from diverse points to a common center—the erecting shop—each to find its appropriate place in the body that is to be formed. As part is fitted to part, everything is found adapted accurately to that which it is to join, and rapidly the ponderous thing takes form and swells into huge proportions. When completed, men take hold of the drivers, and roll them once or twice backward and forward, to see that all is clear. Steam is then turned on, and the drivers are sent whirling at a speed that would carry a train thirty miles an hour. Then the inspector advances, and, like a skillful doctor when he examines a patient, lays his hand on the pulse of the engine. The fingers now press the piston rod, and now the connecting arms, drivers, and cylinder heads, to see if there be any jar or disturbance. If there is none, the engine is declared fit for use, and is lowered down upon the rails and rolled out by the side of the railroad, ready to be sent to its point of destination.

Railway Cars for Narrow Gages.

An esteemed correspondent at Portland, Me., sends a communication, in which we find the following practical suggestion:

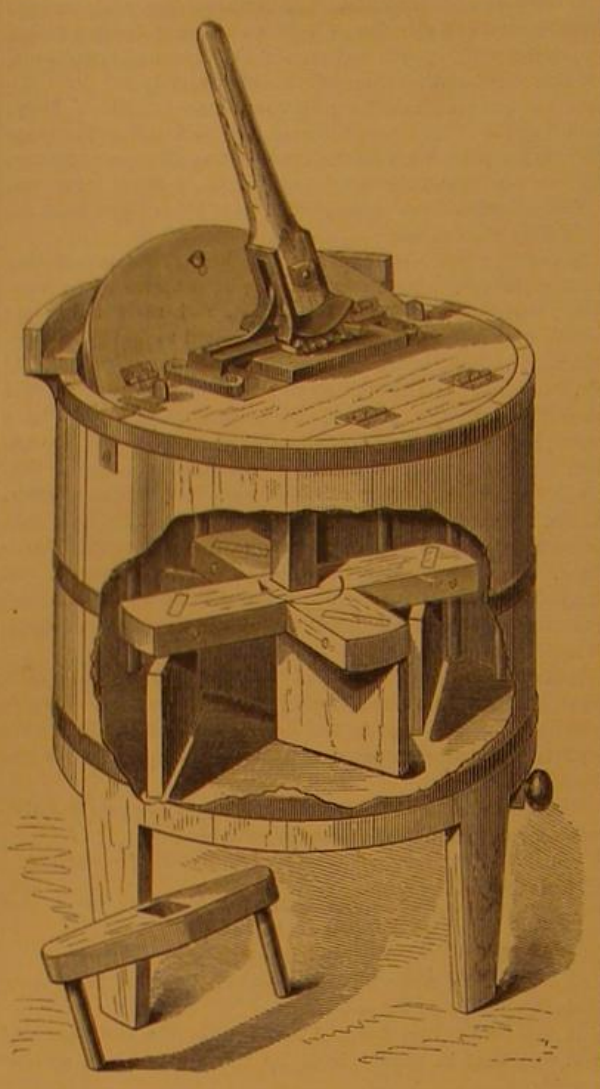
Each trunk railroad to be provided with platform cars of its own gage, on to which the bodies of through cars could be run. The termini of the railroads would need appliances for the transfer of the movable bodies, and by this means, all freight cars would practically become through cars.

The shifting of passenger traffic at places where there are breaks of gage is a matter of slight importance: but the baggage and freight have always been causes of trouble and delay. The plan of our correspondent seems likely, if put in practice, to reduce the chaos of some of the large depots and junctions to system, order, and simplicity.

TO CLEAN BRASS.—Rub the surface of the metal with rotten stone and sweet oil, then rub off with a piece of cotton flannel and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whitening and soft leather. A mixture of muriatic acid and alum dissolved in water, imparts a golden color to brass articles that are steeped in it for a few seconds.

MECHANICAL MOVEMENT FOR CHURNS, WASHING MACHINES, ETC.

Our engraving illustrates a new application of a mechanical movement to the agitation of cream in churns, or suds in washing machines, and also a peculiar form of vertical adjustable rotary dasher, to be used for the agitation of cream. A cross head, with vertical pins, is substituted for the cream dasher when it is desired to use the machine as a washing machine.



The dasher is formed as shown, with obliquely adjusted paddles upon the arms, the inclination of the paddles causing them to react with the outward currents caused by centrifugal force, to throw the cream violently against vertical ribs attached to the inner side of the tub.

When clothes are to be washed, the crossbar with vertical pins is used, and is so constructed that it can be readily substituted for the dasher.

The mechanical movement is not shown in the engraving, but it may be described as being a series of reciprocating cams, acting upon a rotary cam keyed to the vertical shaft of the dasher. The reciprocating arms are fixed to a plate which slides in guides attached to the cover, and receives its motion from an oscillating lever attached to a toothed sector, which sector meshes into a rack on the reciprocating cam plate. The inventor claims that this makes a cheap and effective machine, easily cleaned, and very convenient to use for either washing or churning.

Patented through the Scientific American Patent Agency, May 2, 1871, by John J. Kimball, of Naperville, Ill., whom address for further information.

PAGET'S GIPSY WINCH.

Experiments have been recently made at the International Exhibition on a new form of gipsy winch, the invention of

Fig. 1

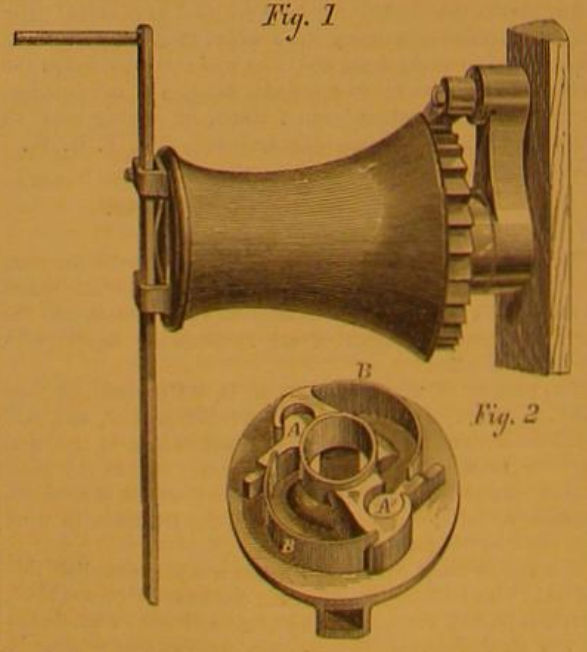


Fig. 2

Mr. Arthur Paget, of Loughborough. Our engraving shows the winch in side elevation, and the interior details of the reverse ratchet. The apparatus consists of a hollow barrel rotating freely on its axis, and to its larger end is affixed the usual ratchet wheel and pawl. The handle of the winch is attached by stirrups to a cap revolving on the axis. This cap is provided with a pair of pawls, A, which, by means of springs, B, are forced against ratchet teeth in the interior of the small end of the barrel. By this means two motions can be applied to the winch, the ordinary rotary method of working the handle, and a reciprocating motion in which the handle is worked up and down in a similar manner to a pump. In the ordinary rotary motion the ratchet movement of the cap is not utilised; but when the maximum power of the apparatus is required the pumping motion is adopted, and the men at the handle are enabled to work at just those positions and distances at which their power is most effective. It will be seen that the handle can be lengthened at will, and different degrees of leverage obtained, as may be found requisite, the radius of the handle being readily altered from 10 inches up to 20 inches, and, by means of adjustable levers, beyond. The apparatus is made self lubricating, the barrel containing a supply of oil sufficient to last an ordinary voyage. In the experiments alluded to, the apparatus being worked by one man with the rotary motion, a strain was put upon a rope of 1¼ cwt., when the radius of handle was 10 inches, and of 3 cwt., when the handle was lengthened to 20 inches. When, however, the handle was worked with the pumping or reciprocating movement, a 20 inch leverage of handle gave the enormous increase of strain of 15 cwt., exactly five times the power obtained with the ordinary rotary motion. The winch with which these expriments were made is only about 4½ in. in diameter at its smaller end.

ENGRAVINGS OF INVENTIONS AND MACHNERY.

During the forthcoming Exhibition of the American Institute in this city, commencing in September, we shall publish a variety of engravings, illustrative of the machinery and improvements there to be exhibited. To those of our readers who desire to have special illustrations prepared for the occasion, we would say, send us your orders as early as possible, so that we can have the engravings executed in good time, thus avoiding delays in publication and overcrowding of our columns.

Upon this subject of engravings, we will remark that our practice of publishing illustrations of new inventions, while it affords interest to every reader, is also of great advantage to the parties immediately concerned. The paramount object of every patentee or manufacturer is to place the merits of his goods or improvements conspicuously before the public; and one of the most effective methods of doing this is by well executed engravings. Good pictorial illustrations impress the eye, arrest the attention, and impart special interest to the subject. The regular edition of the SCIENTIFIC AMERICAN is now between 35,000 and 40,000 copies per week, and it therefore forms an unrivalled medium for the introduction of improvements. The entire expense for the production by us of an engraving, including its publication, is usually much less than the cost of printing an equal number of ordinary circulars.

A VALUABLE BOOK.

We have just issued a new and enlarged edition of our little book upon the Patent Laws, which contains the new Census of 1870 complete, showing the population, by counties, of all the States and Territories of the United States, giving also the areas; and the population of all cities having over 10,000 inhabitants. The book also contains the United States Patent Laws in full, with official rules for proceedings before the Patent Office; instructions how to obtain Patents, both at home and abroad, the costs thereof, etc. Suggestions and advice upon selling Patents are also given, with the forms for assignments. Directions for securing Design Patents, Trade Mark Patents, Copyrights, etc., are likewise given, together with a variety of useful tables and other valuable information, with diagrams of mechanical movements, illustration of the condensing steam engine, etc. About 175 diagrams in all are presented. The book contains 120 pages, and is neatly bound in board covers. Price, only 25 cents. A more valuable compendium for so small a price, has, we think, never before been published. To be had at the SCIENTIFIC AMERICAN office.

WHEATSTONE'S AUTOMATIC INSTRUMENT.—This instrument, which is now being extensively employed in the Postal Telegraph Stations, consists of two parts. By one part, which is called a puncher or perforator, the signals representing the messages are punched out on a ribbon of paper. The punched ribbon is then passed through the other part, which is called the transmitter, which transmits the signals automatically and with unerring accuracy to the other end of the line. The transmitter can work up to 180 words per minute; but the punching, which is done by hand, rarely exceeds a rate of forty words per minute. In order therefore, to get the full value out of the instrument, by equalizing the speed of the punchers and writers with that of the transmitters, it is necessary to employ several punchers and writers to every transmitter, to punch the messages in batches, by several hands, and to divide the received ribbon among several writers.

SOUTHWESTERN EXPOSITION COMPANY OF NEW ORLEANS, LA.—This company has been recently organized, under State laws, for the purpose of establishing a permanent exhibition of machinery, furniture, household goods of all kinds, textile fabrics, ornamental articles, etc. Goods exhibited will be for sale, and the public will be admitted free. Manufacturers and others taking space, in the large and commodious iron building belonging to the company, are promised the advantages of widespread publicity. Further particulars will be found in our advertising columns.

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DR. CROOKES ON PSYCHIC FORCE.

If we mistake not, the article published on another page from the London *Quarterly Journal of Science*, containing engravings illustrative of experiments made by Dr. Crookes, with what he styles "psychic force," will attract attention. The high source from which the article is taken, and to which it was contributed by a man long known as a scientist, whose reputation as such is too valuable to himself to be rashly risked, commands more than the usual respect accorded to extraordinary statements.

The existence of a force in the animal organism which may as well be called "psychic" as otherwise, has long been admitted by both the scientific and unscientific. This force underlies all forms of muscular motion, and as yet has never been proved identical with any other known force. That this force could move inanimate objects external to the body without the intervention of muscular energy has been hitherto denied *in toto*. Yet from time immemorial there have been recorded instances wherein bodies appeared to move at the will of witches, miracle performers, spiritual mediums, jugglers, etc., without any apparent material medium between the will and the objects moved. It would be foreign to our purpose to enumerate any of these alleged occurrences; the accounts of them are accessible to our readers in any large library, and are not wanting in the Bible itself. Dr. Crookes has, however, proved, he thinks, that there is a force—whether identical with that which govern muscular motion or not, he does not pretend to say—which does not only move bodies without muscular intervention, but systematically and intelligently, an instance of which he gives—that of an accordion playing an air in a pleasing and accurate manner, without being actuated by visible hands.

That Dr. Crookes does not wilfully mistate, his past record, as well as his present standing, testifies. His life having been spent in making scientific experiments, in criticising the experiments of others, and in familiarizing himself with scientific methods, it seems almost as hard to believe he was duped as to believe he would deliberately falsify on such a matter. But many an honest and careful observer has been deceived by the subtle tricks of legerdemain to which, it must be confessed, most of the so called spiritual performances bear resemblance.

Among the persons present during Dr. Crookes' experiments was a no less brilliant *savant* than Dr. William Huggins, the celebrated astronomer, and Edward William Cox, the well known London lawyer. Both these gentlemen have publicly endorsed, by letters over their own signatures, which we publish elsewhere, the extreme accuracy of Dr. Crookes' account of the events which transpired at the sitting, though Mr. Huggins reserves his opinion as to the cause. Mr. Cox, however, concurs with Dr. Crookes in assigning the movements to a psychic force, which may, it seems, be subjected to the scientific touchstone, the balance, and hence is within the proper sphere of physical investigation.

We are glad these investigations are thus initiated. Heretofore, when anything out of the common way has occurred, a solution has been found by a certain class of minds, in the belief that spirits of the dead revisit the earth and manifest their presence by out-of-the-way performances, etc. If the existence of psychic force be now accepted as proved, it will give the spirits a chance to rest; their services will no longer be required.

These experiments, performed through the presence of the celebrated spiritual medium, Daniel Dunglas Home, are no more remarkable than those exhibited in this country by other mediums we could name, and which we have frequently witnessed. It is their subjection to strict scientific scrutiny that renders them noticeable at this time.

THE LATE GENERAL RODMAN.

In the bright galaxy of American inventors who, by their creative genius, have shed luster upon their country's name, there are few who, for originality of thought, and wide expansion of views, are worthy of a more honorable place than the late General Rodman. There are in the records of his life, which has just been brought to a premature close, passages which are worthy of consideration by his fellow inventors, for their encouragement and imitation.

Thomas J. Rodman was born in Salem, Ind., July 30, 1815, and, like most of the youth of the West at that day, his early advantages for education were limited. Until he was nearly twenty-one years of age, he was engaged in tilling the soil of his father's farm. By his own exertion he obtained an appointment as cadet at West Point, and by close attention to his studies, the importance of which was thoroughly impressed upon him, on July 1, 1841, he was graduated seventh in a class of fifty-two members. He was at once commissioned as brevet second lieutenant in the Ordnance department, and assigned to duty at the arsenal near Pittsburgh, Pa. Here he became familiar with the practical details of the operations carried on in the shops, and developed an unusual mechanical turn of mind as well as taste for such pursuits.

A few years later he was placed on duty at the Fort Pitt foundery, to superintend the manufacture of large guns there being made for the army; and while engaged in the performance of this duty, he was led to make a thorough investigation into the various strains to which a gun is subjected in firing; and he was convinced that our cast iron guns were made on a wrong principle. His first invention was a compound gun formed of a wire wrapped around an iron core, but this was given up, and his improved method of casting iron guns followed soon after.

He made every effort to induce the Government to undertake to make guns in this way, but the officers of rank and influence did not appreciate the merits of the invention, and declined to take any steps to test its value. Despairing of ever seeing his improvement tried by the Government, he was given permission to try private enterprise, securing to the parties the exclusive right to make guns in that way, should it prove valuable. It took fourteen years to prove, to the satisfaction of the authorities, the superiority of this mode of casting guns; no less than eight pairs of guns were made and tested; in every case the hollow cast gun, after General Rodman's plan, proving the better gun. Most inventors know something of the difficulty of overcoming early prejudices, in introducing something new and different from that in common use, In 1860, General Rodman undertook to make a fifteen-inch gun, weighing 50,000 lbs., and throwing a 450 lb. ball. This was a great step in advance—the largest guns then in use being eleven-inch, weighing 15,700 lbs. The trial of this gun was entirely successful, and in 1864, a twenty-inch gun was cast, weighing 116,000 lbs., and throwing a solid shot, weighing 1,080 lbs., over four miles.

By the use of this mode of casting, larger guns were made possible than had ever been conceived of for the use of iron solid shot; and the monster artillery has proved itself formidable to an extent little thought of when first undertaken.

General Rodman's improvement in the exterior model of guns was the result of an elaborate discussion of the strain to which they are subjected, he having deduced a mathematical formula giving the tendency to rupture at all points of the bore.

This is the most complete analysis of the different strains to which guns are subjected anywhere to be found, in any language.

The location of the trunnions so that the gun shall be balanced on them, was a novel idea, opposed to all preconceived opinions on the subject, and at first deemed absurd and ridiculous.

Attempts have been made at different times to measure the pressure exerted by gunpowder, but in all cases the quantity of powder experimented upon was extremely small. It had never been attempted by any one to measure the strain on a gun from firing eight or ten pounds of powder. This information being most desirable, General Rodman proposed for its determination his pressure piston, which has proved so satisfactory, at least as a comparative test of the pressure of different charges, that it has been generally adopted by the European nations, and is of the greatest value in trials of powders, and different charges of powder.

The invention of General Rodman, which is deemed his greatest, and will prove most useful to all nations, is his improvement in powder for heavy guns; the establishment of the principle, in the first place, that the powder must be adapted to the gun in which it is to be used; and, in the next place, proposing a new and improved form of powder for heavy guns. Previous to his experiments on powder, there was but one kind used in common for all cannon, irrespective of size or length, and little or no attention was paid to the density. He showed that, as the charge and length of bore increased, so must the size of the grain. For very large guns, he proposed a cake powder with small cylindrical holes parallel to each other running through it. The trials with this have proved most satisfactory, and it has been adopted by both the Russian and the Prussian governments, under the name of "prismatic powder." By its use, we are enabled to give a higher velocity to the projectile without increasing the strain upon the gun, and thereby rendering it practicable to use larger guns than could otherwise have been done. The importance of doing this, for the defense of our harbors and sea coast towns, cannot be too highly appreciated, and the necessity for it has been rendered greater of late years by the great advance made in armor-clad vessels.

The English Government for a long time ignored this improvement in powder for heavy guns, but has recently woken up to its importance, and now extols it under the name of "pebble powder."

General Rodman never took out a patent for this invention, as it could only be of use to nations, and not to individuals; and notwithstanding its acknowledged value, as shown by its adoption by most of the nations, he has never received any compensation for its use or any acknowledgment of his services in proposing it.

At the different arsenals where he served, General Rodman has left evidence of his inventive faculty, in numerous improvements in machinery and implements used in the military service.

His inventions were mostly confined to those articles to which his attention was necessarily attracted in the course of his professional duties, and it is on this account that his reputation as an inventor is not better known beyond the limits of the army. He took out but few patents, and most of his inventions have brought him in no pecuniary return. His patent for casting guns, which the Government could have had for nothing, or could have purchased for a moderate compensation after its merits had been thoroughly proved, paid him, during the war, when large guns were in great demand, a handsome fortune. The wrapped metal cartridge for small arms, of which he was the partial inventor, long before it was taken up by Captain Boxer for the English musket, also brought him a fair return.

The simple habits and tastes of his early years remained with him through life. Prudence, carefulness, a sound judgment, originality of conception, widely extended grasp of thought, and conscientious discharge of duty, were his marked characteristics.

Laborious preparation for his work, and unremitting attention to it, without due relaxation, rest, and, recreation, undermined by degrees a constitution, which, strong by nature, and strengthened by early physical training, might have, by proper care, attained at least its three score and ten years.

Like that of many of the active, laborious men of this restless age, his work, which was creditable alike to himself, his profession, and his native country, was brought at an early age (fifty-six) to a premature close.

The results of his labors, upon which our judgment of his merits as an inventor must be based, will, when fully known, duly considered and impartially weighed, establish what is claimed for him, a just title to be ranked high among the most distinguished of American inventors.

GOLD AND SILVER WASTE.

We have before denounced the system of piratical and unscientific mining, which has characterized the search for precious metals in this country ever since the discovery of gold in California. The skimming of the surface, working it only so long as it would pay by the rude processes of the early miners, has at last given place to far more systematic working of quartz lodes. But even under the improved methods now employed, there is probably no more precarious business of legitimate character now prosecuted, than gold or silver mining. The working of a lode of a certain degree of richness is prosecuted till a streak is struck that will not pay; and in the hope that it will pay better ultimately, money is sunk, until better luck or final bankruptcy is reached—too often the latter.

It can, and has been, shown that the waste still existing in the methods of extracting precious metals, would itself be a paying profit, could it be turned into the pockets of the mining companies, instead of running out of the sluices. This waste is so large that its mere statement would stagger belief were it not asserted upon unquestionable authority.

Mr. Almarin B. Paul communicates to the *Scientific Press* the results of tests, made by him with the tailings of many quartz mills in California, which go to show that the loss is from *fifty to sixty* per cent of the entire quantity of metal contained in the ores. It seems incredible that with the great attention that has been given to mining and metallurgy, and the large mass of information, now possessed, bearing upon these industries, such a waste should exist; but here are Mr. Paul's figures as evidence:

"I made a test of 50 pounds of tailings for a party who took them a mile below his mill, and the return was 55 per cent of what was his average working. I also made a test of three fourths of a tun, and the result showed the loss in the mill working to be 63 per cent. I could write every column of your paper full of tests corroborative of the fact of the enormous loss in the milling of our gold ores. But these given should be as convincing as more; and I hope enough so, as to waken a desire for investigation at least. From what attention I have given the subject in actual labor, as well as collecting all the data attainable from others, I know that the loss, as a whole, is fully 50 per cent, and, in the majority of mills, all of 60 per cent of what the ore contains."

Preceding what we have quoted, Mr. Paul gives the results of a great number of tests, showing a varying wastage

of from twenty per cent up to the percentage above given. One mill was running out, in tailings, about $340 per diem. Two mills were together wasting $84,960 per annum. Mr. Paul says:

"California, in twenty-one years, has produced over $800,000,000, and wasted $1,000,000,000 more! For the wastage in 'sluicing' is greater than that in quartz mining. The Sacramento river in ages to come, and when it shall be upheaved as was the Sierra Nevada, will gladden the heart of some straggling miner with an auriferous stratum, the wealth of which will throw all histories of Potosis, Comstocks, and Del Reys combined, into the shade.

"To remedy the evil, more care must be taken. The fact is, we are too much of a rushing, reckless people; we have not got sobered down yet; and I don't know as we ever will. It's rush, rush, and make too little solid, permanent, profitable headway. We have oceans of wealth surrounding us, and ought to be the most opulent, refined, and wealthy on earth—the loadstone for God's creation. But how is it, and why is it, that we are not?"

We recently gave a notice of a process, originated in Australia, in which mercury, mixed with sugar, to a state of intimate subdivision was employed instead of the mercury by itself, in the extraction of gold, and we believe scientific men are now fully awake to the importance of any process which shall largely reduce—not to say wholly prevent—the enormous—we had well nigh said, shameful waste of which we have spoken. It is, we believe, within the resources of chemistry and mechanics to accomplish this desired result, and it is perhaps not too much to say that its non-accomplishment is a standing disgrace to technical science.

WILL GUNPOWDER EXPLODE IN A VACUUM?

We had the pleasure, in 1862, in company with Dr. Doremus, of visiting the workshop of the celebrated instrument maker and ingenious experimenter, Bianchi, in Paris; and, among other pieces of apparatus, were shown a contrivance for experimenting upon gunpowder and fulminates in vacuum. The results arrived at by Bianchi were very unexpected and curious; and although they were partly described at the time, we deem them worthy of recapitulation for purposes of information and discussion at the present moment, when the question is likely to come before the courts for adjudication. We need not stop to describe the apparatus there first exhibited to us, as it has since been pictured in some of our text books, and can be procured of dealers in chemical wares, but we will pass to the chief results obtained at the time by experiment.

Rifle, blasting, and cannon powder, either in grains or compressed to cakes, when suddenly heated to a temperature of 2000° Cent., in a large vacuum receiver, burned up quietly and much more slowly than in the air. There was no explosion, and the products of the combustion were different from those obtained from powder under pressure. When the powder was put into a pistol barrel, and the pistol inclosed in the exhausted receiver, and the heat applied as before, the combustion of the powder took place nearly as rapidly as it would in the open air. The partial confinement in the bore of the pistol, although no wad was used, gave this experiment a different character from the other. The behavior of gun cotton in the vacuum was, if possible, still more curious. It burned up slowly from the side on which it was ignited, and in a dark room gave off no light whatsoever. The absence of all appearance of illumination attending this experiment is a phenomenon well worthy the closer investigation of physicists. The experiments were further varied by firing gunpowder in nitrogen, carbonic acid, and other gases, which are not supporters of combustion, with very nearly the same results as were obtained from the combustion of the powder in the open air. The experiments performed by Bianchi were similar to those which Professor Joseph Henry, of the Smithsonian Institution, has been in the habit of exhibiting to army officers for years. He relates that some of the artillery officers preferred to accept his word for it rather than to stand by and see a teacupfull of gunpowder fired by an electric spark under the bell jar of his air pump. It required considerable nerve and unbounded faith in the Professor, to induce any one to witness such an experiment.

During the recent siege of Paris, the researches of Bianchi were turned to practical account, and we have seen it stated that the effectiveness of shells was greatly increased by pumping in considerable quantities of oxygen gas under pressure. The manner of conducting the operation and the details of results have not been published, but there seems to be no doubt that greater execution was attained in this way. Professor Jillson, of Pittsburgh, Pa., has tried numerous experiments with a gun from which the air could be removed, and oxygen or any other gas introduced. In each case, the amount of powder and the weight of the ball was the same; the target was also made of the same material, and the gun placed the same distance from it. When the powder was surrounded by air, the ball penetrated the target to the depth of 2·15 inches; and the same result was obtained when the air was pumped out and the powder was in a vacuum.

Carbonic acid did not materially change the result; and with oxygen gas, the penetration of the target was actually diminished. These results do not necessarily vary from Bianchi's experiments, as the conditions under which they were obtained were so different. It is, however, difficult to explain the diminution of effect where oxygen gas was brought into play, and there is evidently need of more information on this subject.

The use of ball cartridge was very different from the quiet burning up of powder in an open receiver. Bianchi found that even the slight confinement in the bore of the pistol modified the phenomena of combustion.

The effect of firing gunpowder in closed chambers was recently explained by Captain Noble, at a lecture at the Royal Institution, an account of which we gave, on page 297, Vol. XXIV., and need not repeat here. In each cylinder had been placed platinum wire and foil of different degrees of thickness. These had disappeared, and he was unable to say in what chemical state they were until the residues had been examined. It is to be hoped that the analyses of these residues will soon be published, as there is much diversity of opinion as to their probable constitution.

We have had occasion, during the last ten years, to publish numerous experiments upon the explosive force of powder, and the gases produced by its decomposition under pressure, but the literature on the discharge of powders and fulminates in vacuum is quite small, and the testimony is somewhat conflicting. The belief generally entertained appears to be that gunpowder will not explode in vacuum, and that, as in the case of gun cotton, the phenomenon of light is wanting when the air is exhausted.

NEW APPLICATION OF THE OXYHYDROGEN LIGHT TO THE SEPARATION OF METALS, BY TESSIE DU MOTAY, OF PARIS, FRANCE.

This new process, recently devised and patented, is especially applied to the metallurgy of copper. The usual treatment of copper has had until now for its object the extraction of the metal of a certain class of ores, where it is found combined with sulphur, arsenic, antimony, tin, lead, iron, etc. etc. The new method referred to first smelts the metal with a flux of silicates; metallic silicates are formed, in which the sulphur and arsenic are eliminated and replaced by silicic acid.

These metallic silicates are then further treated in a blast furnace, and submitted to the reducing property of incandescent charcoal; the metallic oxides are reduced in a metallic state and fused, and thus collected in ingots.

The ingot thus obtained is composed of a variety of metals from which the copper has to be separated; this object is attained by smelting these ingots in a reverberatory furnace in the presence of atmospheric air, which oxidizes all the metals except the copper; it is by this process of cupellation that M. Tessie du Motay utilizes the slowly oxidizing property of the oxyhydrogen flame, in order to facilitate the separation of the copper; he directs the flame, obtained by burning a mixture of common street gas and oxygen gas, on to the fused mass. The combustion of this gaseous mixture furnishes a certain amount of carbonic acid and oxide of carbon, as well as a small proportion of water; it is this water, claims the inventor, which, at the high temperature to which it is submitted, has the property of oxidizing rapidly all the metals except the copper and lead. The fused metal obtained is then pure copper, if the original ingot contained no lead; and is composed of an alloy of copper and lead, if the ingot contained these two metals.

In this latter case, a subsequent operation must take place, and the metal must be once more smelted and submitted to the oxidation of a current of air furnished by a blower.

The slow oxidation of the oxyhydrogen flame, proposed by M. du Motay, for the separation of the copper, is likely to render good service to metallurgy, as the production of oxygen gas has become in his hands a cheap and accessible process.

NARROW GAGE RAILWAYS.

This subject appears to be "nuts," not only to the engineering publications of the peried, but to the dailies and weeklies devoted to matters and things in general. What is said today we find repeated tomorrow, and the next day new changes are rung on the same old tune. So far as we can see, nothing new upon the subject has been advanced in six months, and really the discussion is becoming monotonous.

That nothing new is said is not surprising, as, in fact, there is nothing new to say. The financial results of some of these roads are good and encouraging, and the example set by the Festinoig railway, in Wales, is being followed with greater or less success in other parts of the world; that is about the sum and substance, yet many of our cotemporaries persist in treating the matter as a grave engineering question, to be debated *ad libitum*, *ad nauseam*, instead of a thing settled and foregone. No one at all posted in engineering progress can fail to see that the narrow gages are just the thing needed in certain localities, and under particular circumstances, and that they are to be extensively used in the future.

Narrow gage railways are, however, not a new idea. They have been used in coal mines, in excavating works, etc., for a long time, and their practicability for passenger traffic, as well as for freight, has been fully demonstrated for two years.

The question of financial policy is one which must be decided for individual cases. There are no general grounds upon which it can be elaborately discussed, and one may read column after column of much that has been written about it without obtaining a single new idea. We submit that the papers interested in the construction of railways for their own localities, may properly discuss the propriety of adopting a particular gage for their proposed roads, but the endless reiteration indulged in by technical journals upon this thread bare topic is becoming flat and unprofitable.

THE WESTFIELD EXPLOSION.

The story of the explosion of the boiler of the steam ferry boat *Westfield*, plying between Staten Island and New York, has been conveyed to every corner of the land. As yet the coroner's inquest is not completed, and the evidence scarcely warrants an opinion as to the cause of the dreadful disaster. It is, however, revealed that the boiler was old and patched, that steam pressure was carried above that authorized by the license, and that the engineer was away from his post at the time of the explosion, and had been so at least five minutes, the pressure being twenty-seven pounds when he left it—two pounds above licenced maximum. How much the pressure rose during his absence is not known; but that it was enough to rend the boiler, to precipitate a large number of persons into eternity, and grievously burn and maim still more, is certain. There may have been negligence on the part of the inspector; that there was culpable neglect on the part of the company and its employés is sure. A patched boiler is not necessarily an unsafe one, but patched principles are always unsafe. And it is because of looseness in the administration of law, and the want of enforced regard to the public welfare on the part of railway and steamboat companies, that the waters of New York Bay were filled with dead and wounded on the last Sunday in July, 1871.

HOW SCIENTIFIC MEN WORK.

In an article published in the *American Exchange and Review*, under the above heading, we find the following paragraph:

"It is said that when an eminent foreign *savant* once called on Dr. Wollaston, desiring to be shown over his laboratories, in which science had been enriched by so many important discoveries, the doctor led him into a little study, pointed to a table on which was an old tea tray containing a few watch glasses, test papers, a small balance, and a blowpipe, and said: 'There is all the laboratory I have.' Now, how was this possible? How could this meager apparatus, which a school boy would find insufficient, serve to suggest and establish some of the highest and most fundamental truths of chemistry? Does not the explanation at once suggest itself that the true field in which the leader of scientific thought works is his own mind? A great man uses the things which he sees, to suggest to him ideal existences; and in his capacity of creating such as are consistent with all the known facts of the universe, his fame and distinction are grounded. Nothing could be farther from the truth than to suppose that science accords with Mr. Gradgrind's demand for 'facts, facts, nothing but facts.' On the contrary, Prof. Tyndall long ago defined science as 'the art of seeing the invisible,' and in a recent brilliant lecture has happily shown that its progress depends largely on the fullest possible use of the imagination."

Now, it may or may not be true that Dr. Wollaston made all his great discoveries with a few watch glasses, a small balance, and a blowpipe. It, however, sounds like the story of George Washington and the hatchet, which was originated by that constitutionally unveracious clergyman, Weems, and who was author of many other pretty stories of great men, equally unreliable. But it is not with the story that we quarrel so much as with the moral drawn from it. "The capacity of a man to create ideal existences such as are consistent with all the known facts of the universe, is what gives him fame and distinction." In other words, speculation, pure and simple, is put before patient investigation, and he is declared the great man who can speculate most ingeniously, rather than the one who sits down patiently to search for new facts.

Thus Newton, for his hypothesis of a force of gravity, should, according to this essayist, take higher rank than for his demonstration that bodies attract each other directly as their masses, and inversely as the squares of the distances between their centers of gravity. Laplace for his nebular theory should receive a meed of glory far greater than for his mathematical researches.

It is true that Tyndall has, in his forcible, figurative way, defined science as "the art of seeing the invisible." But the invisible may be fact as well as the visible. Surely this most hard headed of all our modern thinkers did not mean invisible nothings; and though a free use of the imagination is essential to the scientist, it is that kind of imagination that calls up and groups facts that is of use, not the imagination that enables men to construct theories that have no basis in fact.

The true scientific thinker makes use of hypothesis precisely as the mathematician makes use of an imaginary quantity in an equation, not as a reality, but as a help to the ascertaining of realities. If the hypothesis prove by subsequent investigations to be truth, then, and then only, does he accept it as true. That a hypothesis accounts for known facts, or is consistent with them, only renders it highly probable that the supposition is correct. And when Tyndall says the evidence of the existence of a luminiferous ether is conclusive, he does not talk of this ether as a thing supposed to be, but something proved to be, by *facts*.

The essayist whose false teaching we are striving to correct, makes the error of confounding just inference with hypothesis. A conclusion logically inferred from known facts is very different from a theory devised to correspond with facts.

Neither do scientific men work with poor tools, as this author would have us infer. They seek for the utmost refinement in instruments and processes. It is false teaching to promulgate the doctrine that a man can, with a few pipe bowls and rude appliances, proceed with great chemical investigations, or do good work as an astronomical observer, with spectacle glasses arranged on a board. That one man in a thousand succeeds in doing something worthy with inferior apparatus, only proves his superiority, not that the means are sufficient. The investigations of Wollaston were such as required no better apparatus than he used, or he would never have made his discoveries.

It seems to us that it is about time to put a stop to the trite twaddle about genius working in ways and through means that men of ordinary intelligence cannot comprehend. The true scientific method is to guess at nothing, and proving all things, to hold fast to that which is good.

ARTIFICIAL LEATHER.—UTILIZATION OF LEATHER SCRAPS AND CUTTINGS.

We have been greatly interested in the examination of specimens of artificial leather, made from leather scraps and cuttings, forwarded to us for examination by Mr. P. J. McKenzie Oerting, of Pensacola, Florida, who has the control of the patent right for this country.

It is almost superfluous to say anything in regard to the great value of a cheap and good process for the utilization of leather waste. This waste represents millions of dollars annually. A process that could reproduce a texture of these cuttings, only half as good as the original leather, would be one of national importance, and would at once establish a new industry. The process by which the specimens above referred to are made, is, however, claimed to make uniformly an artificial leather even superior to ordinary tanned sole leather.

Examination of these specimens reveals the following facts: It is much harder than ordinary leather, and does not yield to hammering or compression nearly as much. It is very flexible and elastic. Thin shavings of it possess as great tensile strength as shavings of equal thickness of common oak tanned leather. It is nearly, if not quite, impervious to water. It cuts smoothly and easily in working. With regard to its durability under wear, we have no doubt it would wear longer than sole leather, provided it does not decompose by exposure. We have no means of determining this latter point, but we are assured that it does not decompose or change under the ordinary circumstances of wear to which leather is exposed in its various uses.

It is claimed that the leather thus made is equally good for soles or belting; and our tests as to its tensile strength, flexibility, and elasticity certainly go to corroborate the claim.

A really good method for making artificial leather of scraps has, as our readers are well aware, long been sought; but heretofore nothing has been obtained that combined all the essential properties of good leather. The method under consideration was first brought out in Copenhagen, Denmark, and has been patented both in Europe and America. The ingredients employed and their proportions are as follows: For first quality, one pound caoutchouc for each three and a quarter pounds leather pulp. For other qualities, the proportion of leather pulp is increased variously up to six pounds for one pound of caoutchouc. The caoutchouc is dissolved in benzine or other solvents, and, when sufficiently dissolved, aqua ammonia is added in the same proportion as that of the rubber, and the mass is thoroughly stirred until it assumes a grayish white color. The leather pulp is then added, and the whole is kneaded into a plastic homogeneous dough of uniform consistency, which can be pressed or molded into any required form, or rolled into sheets, as may be required.

The ammonia is claimed to act upon the animal glue in the cuttings, restoring to it its original vitality, which it has lost to a great degree in the process of tanning.

The following are some of the properties and uses of this remarkable substance, as claimed by Mr. Oerting in his letter accompanying the specimens:

"Its waterproof quality makes it especially valuable for pump leather, as well for cold as hot water, and also for harness, as even a continued exposure to all kinds of weather has no effect on it, occasioning neither rot nor crack. It can be made endless, or of any length, width, and thickness required, and of perfect uniformity as to wear, which is generally well known to be impossible with leather belts made of shorter pieces of different hides, and of unequal wearing capacity. It will stand any amount of heat and friction, as well as the most intense cold, will stretch less than any other belting, and can be changed from one pulley to another with ease and rapidity. It is very strong and substantial in the edge, and will stand a great amount of ill use without suffering any injury, and through its combined properties will supply a desideratum much needed. By suitable machinery for molding, or forming the material in its doughy state into hose, fire buckets, etc., for which purpose it is especially adapted on account of its flexibility, impenetrability by water, and its capacity to withstand any amount of hardship, as well as extreme heat or cold, it will certainly make the best as also the cheapest material yet produced for such purposes."

By a different mixture and proportion of the ingredients, a matting for floor covering is made, which, on account of its cheapness, its waterproof properties, and its capacity to keep rooms protected from cold and dampness, makes, it is claimed, an unequaled article for covering offices, passage ways of public buildings, etc., which will withstand an immense amount of wear, and can very easily be cleaned.

We are informed by Mr. Oerting that the cost of the materials employed in its manufacture amounts to about 11¼, 13½, 16½, and 19 cents per pound for the different qualities, besides from twelve to fourteen ounces of scrap leather, which prices, calculated after the present rates of the raw ingredients, would be reduced at least ten to fifteen per cent by a direct importation in larger quantities.

The entire right for the United States, or State rights for this invention will be sold. For samples or further information, address Mr. Oerting as above.

Mr. Oerting will be happy to furnish specimens to persons interested in such matters, and would like to correspond with parties who wish to engage in the manufacture.

TO CLEAR MUDDY WATER.—A little dissolved alum is very effective in clearing muddy water. If thrown into a tub of soap suds, the soap, curdled and accompanied by the mud particles, sinks to the bottom, leaving the water above clear and pure. In times of scarcity of water, this may be used again for washing clothes.

RE-AGENT TO DETECT NITRIC ACID.

The proposed re-agent is the sulphate of aniline; it detects, with the most minute accuracy, the least traces of nitric acid. In order to obtain the desired result, the *modus operandi* is as follows: Place in a watch glass about 1 cubic centimeter of pure and concentrated sulphuric acid at a density of 1·84; then pour, drop by drop, half a cubic centimeter of a solution of sulphate of aniline, prepared by mixing 10 drops of commercial aniline with 50 cubic centimeters of diluted sulphuric acid. A glass rod is then dipped in the liquid to be tested, and it is then introduced in the watch glass and stirred in a circular way; from time to time the experimenter should blow slowly on the agitated liquid; if the liquid thus stirred contains traces of nitric acid, circular lines of a deep red are soon visible, coloring the whole liquid to a pink. On adding a very small quantity of nitric acid to the mixture, the liquid becomes of a carmine color; the addition of a single drop of very diluted nitric acid renders the liquid a deep red, and afterwards a dead red. This simple process can be applied to the detection of nitric acid in the commercial sulphuric acid. I have thus been able to detect nitric acid in water from wells; and generally this acid is to be found in rain water after a storm.

Hypoazotic or hyponitric acid produces also the same re-action; morever, when only traces of hyponitric acid are detected, the distinction can easily be made by the use of starch and iodide of potassium, acidulated by sulphuric acid.

OZONIZED ETHER.

Ozonized ether has attracted much attention abroad, and we proceed to explain the way it is prepared. It is peroxide of hydrogen in solution in ether. The first idea of this mixture belongs to Mr. Richardson; in experimenting on the action of the peroxide of hydrogen on a number of various organic and inorganic substances, it came into his mind to add to ether a strong solution of peroxide of hydrogen. He was rather astonished in passing a large portion of this substance into ether to find that, after decantation, the ether retained a strong flavor of the peroxide of hydrogen used; and the ether treated by oxide of manganese disengaged a large amount of oxygen; he also noticed that, after a certain time, the oxygen was still retained. The addition of a small quantity of alcohol to the ether facilitates the absorption of the peroxide of hydrogen by the ether.

The combination remains permanent, as some peroxide of ether, having been shipped to Australia and back, had suffered no alteration. This compound constitutes, without doubt, a very strong agent, and will most probably take the place of one of the most important remedies. The peroxide of hydrogen has been used for changing the color of the human hair into that light butter color which was *à la mode* in Europe lately; and it has also been used as a disinfectant of hospitals: its action is very rapid, and does not overload the atmosphere with moisture, and does not irritate the respiratory organs; but it has an inconvenience, it cannot be used near a fire or a light. The remedy for this objection is to use it by means of a glass tube for the evaporation in an atomizer.

EDITORIAL SUMMARY.

TYRRELL'S LABELLING MACHINE.—In our last volume we published an engraving of this ingenious invention, and we are pleased to hear that it is having an extensive introduction. It is applicable for use in labeling every description of round boxes, cans, etc. The latter are fed into a hopper, from which they pass, one by one, in regular procession, the labels being pasted and pressed upon the boxes as they pass, without any hand work whatever; in fact, the machine appears as if endowed with intelligence, for it picks up the labels one at a time, pastes them, and sticks them upon the boxes or cans. Besides the important saving in manual labor which the machine effects, the work done is executed in a neat and superior manner. The invention is now in practical use in some of our largest canning establishments, and operates with the most complete success. Recently patented in this country and Europe. Further information may be obtained by addressing the inventor, Mr. Edward Tyrrell, No. 281 Plymouth St., Brooklyn, N. Y.

We would call the especial attention of parties desiring to engage in an established and successful business, to the advertisement of the Eclipse Machine Works at Hamilton, O. The firm consists of Messrs. Owens, Lane, Dyer & Co. Some of the partners, having made all the money they want, are about to retire; and a half share in the business is about to be sold. The reputation of the concern is first class.

A NEW fire alarm cable, weighing four tons, constructed of the heaviest armor and strong enough to hold any vessel so that it cannot be broken, has been succesfully laid to East Boston. It contains five conductors, two of which are used for the fire alarm, and there are two extra. One will be used for the police telegraph.

METEORIC IRON FROM VIRGINIA.—Professor Mallet, in the *American Journal of Science and Art*, gives the following analysis of a meteoric mass found in Virginia, near Staunton: Iron, 88·706; nickel, 10·163; cobalt, ·396; copper, ·003; tin, 00·2; manganese, trace; phosphorus, ·341; sulphur, ·019; chlorine, ·003; carbon, ·172; silica, ·067. Total, 99·872.

THE Iron Works Company at Fall River are now building seventy-four large boilers. Seventy-two of these are for the new Durfee, Granite and Stafford Mills. They are the common cylinder boiler, and are each 50 feet long by 2½ feet diameter. Some fifty men are now employed on these boilers.

FUNGUS THE CAUSE OF WHOOPING-COUGH.—Dr. Letzerich the American pathologist, has recently made a series of experiments with a form of fungoid growth which he believes to be the cause of the very tronblesome disease, whooping-cough. The spores found in the expectorated mucus, causing the irritation and coughing, were allowed to vegetate into large masses, and small portions were then introduced into young rabbits by an opening in the windpipe. The wounds thus made soon healed, but the animal became affected with a violent cough. Several animals thus diseased were killed and the air passages in each were found to contain very large quantities of similar fungus. These observations, so important to the advocates of the germ theory, have not as yet, been confirmed by other investigators in the same field.

THE enterprising and well known thread manufacturers, Messrs. J. and J. Clark, Paisley, are about to build another large factory for manufacturing thread and sewing cotton. Between the two wings of which it will consist, there will be the engine house, which will be furnished with compound beam engines of 1,200 indicated horse power, being the largest in use for manufacturing purposes in Scotland. The fly wheel alone will weigh not less than 55 tons, and in order to make a proper foundation for this gigantic machinery 10,000 cubic feet of stone will be required. Messrs. Musgrove and Sons, Bolton, are the contractors for the engines and boilers.

AMONG THE INVENTIONS shown in the International Exhibition now open in London, is an ordinary sewing machine from France, the peculiarity of which is that it is driven by a clockwork arrangement, which is wound up in the usual way. Fixed on the apparatus, which is enclosed in a case beneath the machine itself, is a set of vanes, which can be adjusted to work at any angle, so that the speed of the machine is regulated by the greater or less resistance which they offer to the air. They form, in fact, the governor of the machine. The application is ingenious, and will of course save much time and labor, but its price is high, so that there are only two classes of the rich that will patronize it, namely, the delicate and the lazy.

IN his important work on "Mechanics," the late Dr. Whewell, Master of Trinity College, Cambridge, wrote unconsciously the following verse: "There is no force, however great, can stretch a cord, however fine, into a horizontal line that shall be accurately straight."

NEW BOOKS AND PUBLICATIONS.

A GENERAL TREATISE ON THE MANUFACTURE OF VINEGAR, THEORETICAL AND PRACTICAL. Comprising the Chemical Principles involved in the Preparation of Acetic Acid and its Derivatives, and the Practical Details of the various Methods of Preparing Vinegar by the Slow and Quick Processes, with Alcohol, Wine, Grain, Malt, Cider, Molasses, Beets, etc., as well as the Fabrication of Pyroligneous Acid, Wood Vinegar, etc., etc. Together with their Applications, and a Treatise on Acetometry. By H. Dussauce, sometime of the Laboratories of the French Government, Author of "A General Treatise on the Manufacture of Soap," "A Complete Treatise on Tanning, Currying, and Leather Dressing," etc., etc. With Illustrations. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. London: Sampson Low, Son & Marston, Crown Buildings, 188 Fleet street. Price, by mail, free of postage, $5·00.

The works of Professor Dussauce rank deservedly high as industrial publications. Their best feature is profuseness in the treatment of practical details. The present work is no exception in this respect. The work is probably the most complete treatise on the subject of vinegar manufacture now extant. It should be in the hands of every brewer, distiller, and manufacturer; for though it treats more especially of vinegar making, the departments devoted to malting and cognate subjects are valuable in all these branches of business.

THE COOLIE—HIS RIGHTS AND WRONGS. By the author of "Ginx's Baby." Author's Edition. New York: George Routledge & Sons, 416 Broome street.

The author of "Ginx's Baby," no doubt stimulated by the unusual success of that incisive little book, has published a work of more serious tone and higher aim. This book discusses the labor question, in the West Indies and elsewhere, with especial regard to the immigration now going on from from China and India. The state of the West Indies, and the suitability of those islands for homes for the Mongolian and other Eastern races are fully discussed, as well as the agencies in the East for enlisting emigrants. The same questions, with regard to importation of laborers in Guiana are also well and ably treated. The work is thorough and exhaustive, and shows the author to be a man of intelligence and observation, who has traveled, seen, and thought much. He dates from the "Temple, London," and thus gives the first clue to the personality of the writer of "Ginx's Baby."

A PRACTICAL TREATISE ON THE PREPARATION, COMBINATION, AND APPLICATION OF CALCAREOUS AND HYDRAULIC LIMES AND CEMENTS. Compiled and Arranged from the Best Authorities, and from the Practical Experience of the Compiler during a long professional career. To which are added many useful Recipes for various Scientific, Mercantile, and Domestic Purposes. By James G Austin, Architect. New York: John Wiley & Son, 15 Astor Place.

This is one of those universally useful books which may be read with profit by almost any one.

SUPPLEMENT AND INDEX TO "THE LATHE AND ITS USES," New York: John Wiley & Son, 15 Astor Place.

An important addendum to a work issued by the above named firm in 1868. It is published in pamphlet form, and contains a description of the manufacture of the celebrated Tunbridge ware.

TABLES OF WEIGHTS, MEASURES, COINS, ETC., OF THE UNITED STATES AND ENGLAND, with their Equivalents in the French Decimal System. Arranged by T. Eggleston, Professor of Mineralogy and Metallurgy, Columbia College. New York: John Wiley & Son.

A handy little manual.

TRAVELERS' RAILWAY GUIDE.

This work, published under the auspices of the National General Ticket Agents' Association, and edited by Edward Vernon, is probably the best work of its kind now issued. It is published by the National Railway Publication Company, 237 Dock street, Philadelphia, Pa., and can be procured of news dealers.

THE flying frog is an animal, of the existence of which comparatively few people are aware; yet Mr. A. R. Wallace, during his travels in the Malay Archipelago, found one on the island of Borneo—an island so vast in size that the whole of Great Britain, if set down in the middle of it, would be surrounded on all sides by a sea of forests. This frog was a large tree-frog, with very long toes, fully webbed to their very extremity, so that when expanded, they offered a surface much larger than the body of the animal itself. He was seen to come down from a high tree, through the air, in a slanting direction, as if flying.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

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

Preliminary Examination.

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

Caveats.

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

To Make an Application for a Patent.

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

Re-Issues.

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

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row New York.

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

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

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

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Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

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MUNN & Co. have solicited a larger number of European Patents than any other agency. They have agents located at London, Paris, Brussels Berlin, and other chief cities. A pamphlet pertaining to foreign patents and the cost of procuring patents in all countries, sent free.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinion, and advice, *no charge is made*. Write plain, do not use pencil, nor pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice,

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Miss Marie E. Stacey, of Hamilton, Ont., has used her Wheeler & Wilson Machine 14 years, since she was 8 years of age, principally in mattress and upholstery work; has made 20 large size mattress ticks in a day, with plenty of leisure; has earned at least $10,000 with it. The family sewing is pleasant amusement.

Says the Muscatine (Iowa) *Courier:* "We have done, and are still doing business with quite a number of advertising agencies throughout the country, and have no fault to find with them, but Messrs. Geo. P. Rowell & Co. give us more business than any other. Furnishing a large amount of advertising, and paying promptly, has put this house at the very head of agencies, and has made them a name for honesty, reliability, liberality, and promptness, which of itself is worth a fortune."

Barnett's Cocoaine needs only to be tried. It dresses the hair beautifully.

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Copper and Brass Seamless Tubes (from 3-8 to 5 in. outside diameter. Merchant & Co., 507 Market st., Philadelphia.

The Eccentric Elliptic Geared Power Presses are the best in the world. For Circulars, address Ivens & Brooke, Trenton, N.J.

$50,000 can be made from Abbe's Patent Bolt Forging Machine in a short time. Best designed in United States. Investigate. Patent for sale. Address John R. Abbe, 110 John st., Providence, R.I.

The Baxter Steam Engine will not explode.

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

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

Lord's Boiler Powder is only 15 cts. per pound by the bbl., and guaranteed to remove any scale that forms in steam boilers. Our Circular, with terms and references, will satisfy all. Geo. W. Lord, 107 W. Girard ave., Philadelphia, Pa.

The Baxter Steam Engine pays no extra insurance.

L. & J. W. Feuchtwanger, Chemists, 55 Cedar st., New York, manufacturers of Silicates of Soda and Potash, and Soluble Glass.

For Hydraulic Jacks, Punches, or Presses, write for circular to E. Lyon, 470 Grand st., New York.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

Copper and Brass Seamless Tubes (from 3-8 to 5 in. outside diameter). Merchant & Co., 507 Market st., Philadelphia.

Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

Dealers in mill machinery, please send address to S. H. Soule, Binghamton, N. Y.

The Baxter Steam Engine Co., 18 Park Place, New York, have the most economical engine. Sizes 2 to 10 H.P. Send for Circular.

Wanted—A small Gas Holder, about 6 ft.x6 ft., and tank, in good condition. Address J. M. Crafts, Lenox, Mass.

Quinn's Patent Ferrule makes good all leaky boiler tubes. Address P. Quinn, South Newmarket, N. H.

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See advertisement of new Machinist's tool on last page.

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

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First class. Send for circulars and price lists. Greenleaf Machine Works, Indianapolis, Ind.

M'fr's of Steel, Builders' Hardware, &c., secure rights to make the iron and steel work in the Reversible Sash illustrated in SCI. AMER'N, July 22, 1871. Guides to be rolled steel. A big trade, and rights low.

M'fr's or importers of Corrugated Iron or Steel Wire, send address to W. P. Nelson, 618 N. Main St., St. Louis, Mo. Want the wire for keys to reversible sash illustrated in SCIENTIFIC AMERICAN, July 22, 1871.

Wanted—A good Chucking Lathe, 14 in. swing, for ¼ to 2 in. holes. Send price and description to Lock Box 129, Woonsocket, R. I.

Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth st., Brooklyn, manufacture Presses and Dies. Send for Catalogue.

Wanted—One new or second-hand Woodward's Planing and Tonguing and Grooving Machine, in good order. Address H. G. Hall Fayetteville, N. C.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.

A Chemist wants a place at $800 the first year. Address Charles E. Avery, 19 Chester Park, Boston.

Wanted—A practical Foundryman as partner in an old and well established Foundry. Address Jas. H. Dudley, Poughkeepsie, N. Y.

Wanted—To invest $500 to $5,000 in a good paying Manufacturing or Mercantile Business. Address Box 574, Pittsburgh, Pa.

Manufacturers of Steam Pile Drivers, adapted to railroad construction. Address O. T. Gibbes, Box 573, Augusta, Ga.

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

For Sale—14 H.P. Engine and Boiler, used 90 days. Machinery to sink an artesian well. J. C. Burruss, Carrollton, Ill.

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For Sale—A Patent on Steam Mangle. Address P. Rundquist, 954 Sixth Avenue, New York City.

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

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

The Baxter Steam Engine is manufactured by Colt's Arms Co., Hartford, Ct., and sold by the B. S. E. Co., 18 Park Place, New York.

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.

FINISHING WALNUT WOOD.—Mix, with good whiting, such colors as will produce as near as possible the color of the wood to be filled. This mixture to be dry. Then give the wood a good coat of oil, and sprinkle the mixture over the work until it is pretty well covered; then with a soft rag or other soft substance, rub this in well. Wipe off all superfluous material. Let dry thoroughly and varnish. This mode is far superior to sizing.—J. B., JR.

BELTS.—I have always found, in a long experience, that leather belting used with hair side to pulley will both last longer and accomplish more work than when used with flesh side to same. The fibre of hair side is more compact and solid than that of flesh side, and consequently more of its surface is constantly brought in contact with the particles of the pulley. What is lost by want of contact must be supplied by an extra strain on the band.—R. H. P., of Ohio.

MENDING PIPE.—If B. H. D. will take glycerin and add to it enough litharge to form a paste as thick as putty, and use while soft, he will undoubtedly mend his pipe so that it will stand both heat and water. W. J. B. of N. Y.

VARNISH.—Querist, B. F. B., page 43, current volume, wants thin varnish and one that will dry. Let him make it as follows: Pound up ten ounces of gum sandarac, four ounces of mastic, and half an ounce of camphor, adding three quarts of strong alcohol; the mass to be frequently stirred up, and finally put in a warm place until it settles. This varnish does not peel off, and therefore can be applied very thin.—H. W. G., of Mich.

MILL PICKS.—F. A. K., querist No. 3, page 43, wants a good receipt for tempering mill picks. I submit the following:—To six quarts of soft water, put in pulverized corrosive sublimate one ounce, and two handfuls of common salt. When dissolved it is ready for use. The first gives toughness to the steel, while the latter gives the hardness. Directions: Heat the picks to only a cherry red and plunge them in, and do not draw any temper. In working mill picks, be very careful not to overheat them, but work them at as low a heat as possible.—H. W. G., of Mich.

TO PREVENT KINKS IN FALL ROPES.—Let N. S. put a swivel in the single block as shown in the diagram annexed. If properly proportional to the size of the block, so as to give as little friction as possible, he will find this attachment will remove all trouble from kinking.—P.K., of N.Y

SEALING FRUIT CANS.—If J. B. H. will use gum shellac instead of resin, he will have no more trouble.—B. P. G., of Mass.

W. B. S., of Pa.—Dry steam is steam which contains no water unconverted into steam.—P. K., of N. Y.

BELTS.—J. F. M. asks which is the best side, next to pulley, to run a leather belt. According to experiment, the comparative working per cent of grain or hair side is 31 per cent; flesh side 23 per cent. The grain side will therefore drive 34 per cent more than flesh side, to pulley, and will also last much longer.—B. P. G., of Mass.

BELTS.—In answer to J. E. G. According to my observation and experience, a running belt nearly vertical will run to the highest side, but belts running at from nearly an angle of 45° to horizontal, will run to the end of the pulley, where the shafts are nearest together, the pulleys in both cases being straight faced.—B. P. G., of Mass.

RESTORING BURNT STEEL.—I know of no compound for that purpose, that is as good as resin alone. To have in convenient form for use, melt the resin, then add sperm oil, to make a thin paste when cold. Stir in powdered charcoal enough to make a thick paste.—B. P. G., of Mass.

WASHING ETHER.—This operation is for the removal of alcohol, and may be done by agitating with twice the bulk of water, which will unite with the alcohol, forming a heavier stratum from which the ether may be poured off. The ether will absorb ten per cent of the water which can be removed by agitation with freshly burnt lime and subsequent distillation.—D. B., of N. Y.

J. E. G., of Pa.—When the horse power of a boiler is given, find the area of safety valve as follows: Multiply the square of the diameter of the cylinder of the engine, (supposed to be of the same horse power as the boiler), in inches, by the speed of the piston per minute, in feet, and divide the product by 375 times the pressure per square inch the boiler is designed to carry; the quotient is the proper area of valve port in square inches. Having thus ascertained the area and having fixed upon the length and dimensions of the lever, and distance of the fulcrum from the valve stem, multiply the weight of the lever, in pounds, by the distance from its center of gravity to the fulcrum, in inches, and divide the product by the distance from the center of the valve stem to the fulcrum, in inches; subtract this quotient from the pressure upon the valve, in pounds, and multiply the remainder by the distance from the center of the valve stem to the fulcrum, in inches, and divide the product by the length of the lever in inches, measured from the fulcrum to the point of suspension of the weight The quotient will be the weight required in pounds.

ELECTRIC LIGHT.—Not knowing the comparative value of electric lights produced by Grove's and Bunsen's cells, I cannot state exactly how large a number of the former would equal in effect a given number of the latter, but I should think twenty of Grove's would equal ten of Bunsen's. The points should be made of gas carbon, and connected directly with the poles of the battery. I know of no special difficulty in arranging them so as to produce a good light. There are electric lamps in market, but I know not where they can be obtained.—E. H. M., of Mass.

FINISHING WALNUT.—Let H. W. M., query 8, page 60, try, of equal parts, boiled linseed oil, Japan dryers, and spirits of turpentine, with wheat flour enough to make a thick paste. Rub down well before it dries. I have never found anything as good for ash and chestnut.—E. A. B.

COPPER SOLUTION.—Some time ago F. R. A. asked for a copper solution. E. C., of N. Y., answered on page 346, Vol. XXIV. I find the following works better either in single cell or separate battery. To every gallon of saturated solution of sulphate of copper, add 2½ ounces of strong sulphuric acid and ½ drachm white arsenic. If single cell, place a bag of sulphate in the solution just below the surface, to keep up the strength. E. M., of Mass.

Declined.

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

BORING AND TURNING CYLINDERS—G. W. P., J. H., and C. H. M.

THE TRADE WINDS—J. H.

MOISTURE IN THE ATMOSPHERE—W. H. H. H.

ELECTRO MOTOR—E. P.

CARDIFF GIANT—E. X.

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.—COVERING BOAT BOTTOMS.—I would like to ask the following question of H. about his composition for boat bottoms: What coloring material would he use, instead of Rocky Mountain vermillion, to produce a blue color?—E. H. M.

2.—ELECTRIC LIGHT.—Is the reason known why more light is obtained from an electric lamp when the positive pole is at the top than when the negative is?—E. H. M.

3.—WATER FOR AQUARIUM.—I have just fitted up an aquarium, and wish to know if good, pure cistern water is injurious to gold or our native fish? Also, is good well water injurious? If not, how often should the water be changed?—G. W. G.

4.—SCREW CUTTING GEAR.—I am making a small lathe, and am not posted in the construction of screw cutting gear wheels. Wil some accommodating mechanic give me a clear and simple rule for that purpose?—GEAR WHEELS.

5.—FEEDING RABBITS.—Can one of your readers tell me on what feed will young rabbits grow best, to get fat quickly? The rabbits are kept in a pen.—J. E. R.

6.—DEATH OF QUEEN BEES.—Will some apiarist tell me the reason why dead queens are found on the lighting board of strong stocks of bees about swarming time?—J. E. R.

7.—COMBUSTION IN BOILER FURNACE.—Can I. by introducing small jets of air into my furnace, under the boiler, improve combustion? If so, which is the best and cheapest mode?—A. H. G.

8.—CUT OFF.—My engine works full stroke. Can I, by substituting an eccentric of less throw, make it cut off shorter without altering anything else?—A. H. G.

9.—POLISHING WAX.—Can any of your readers give me a recipe for making a wax to be applied by a running belt, for finishing hickory handles, etc., that will retain its gloss?—T. McM.

10.—SEASONING LUMBER BY STEAM.—What is the process seasoning lumber by dry steam? What appliances are necessary in the process, besides the steam, and are they expensive? Can green pine be seasoned by the dry steam process in a few days, so that it will be suitable for the manufacture of bee hives?—G. T. W.

11.—LATENT HEAT OF DISSOCIATION.—Will Dr. Vander Weyde explain the theory of the latent heat of dissociation, of which he speaks, in your number of July 22d, as the true origin of the heat developed during combustion? I, and probably many others of your readers, am not acquainted with this theory, and he would do a favor to many by giving a full explanation of this new doctrine, for the previously entertained hypotheses are certainly very unsatisfactory.—E.

12.—BELLOWS FOR BLOWPIPE.—How can I construct a cheap and efficient bellows for a gas or spirit lamp, to be used for experimental purposes?—A. L.

13.—FRICTION OF WATER FLOWING THROUGH PIPES.—I want to deliver water through a pipe 5,000 feet long, and wish a simple rule for computing the friction. I wish to know how much larger I must make it, to deliver the same volume through this length, than if the length were only ten feet.—L. V. H.

14.—SULPHATE OF INDIGO.—Will any of your readers inform me how to make sulphate of indigo? I have dissolved indigo in sulphuric acid, and can only obtain a brown or purple solution. I have followed the directions in the text books on chemistry, and can obtain no other result.—J. T.

15.—SCALING SHEET STEEL.—I would like to find some simple way of removing the scale from the surface of sheet steel, otherwise than by grinding; say by the use of acid or a pickle. The article to be scaled is not over an inch square. Of course the process must leave a bright surface.—H. G.

16.—WASTE IN MELTING PIG IRON.—What percentage of waste is there in melting the following grades of iron, No. 1 pig, No. 2 pig, stove plate scrap, and ordinary mixed scrap? and what combination of the aforesaid grades is considered the most economical for ordinary foundery work, that is, mostly castings finished in casting?—C. C. S.

Recent American and Foreign Patents.

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

STRAW CARRIER FOR THRESHING MACHINES.—The carrier is run on end rollers in the usual manner, and driven by a belt which transmits power to one of the latter. The peculiar construction of the sides of the box constitutes a feature of the improvement. On the lower side of the apron or carrier, is a curved metallic plate, bent to correspond with the sag of the carrier, or apron, the object of which is to collect any grain which passes through the carrier; which grain will be swept downward by the carrier buckets, and delivered at the bottom of the apron. These buckets are strips of wood or metal, attached in such a way that they project at right angles rom the apron. When made of wood they are about a quarter of an inch thick, and project one and one fourth inches. The inventor is Otis Abell, of Witoka, Minn.

HARROW.—Joshua Center, of Mason City, Ill.—This is an improvement upon an invention, patented April 28, 1868, and consists in the combination of pair of handles and their supporting braces with the bars of the harrow.

FENDER FOR PLOWS.—Benjamin F. Neely, of Yorktown, Ind.—A curved fender bar is attached to the plow beam, passing backward and downward toward the share, where it terminates in a number of bars or fingers laterally adjustable so as to allow more or less earth to be thrown towards the plants, when used in cultivating crops planted in rows. The fender bar also plays up and down, so as to adjust itself to unevenness of surface.

STOVE LEG FASTENING.—James M. Corbin, of Liberty, Mo.—Across the base plate of the leg, is fitted a flat spring riveted at the middle. When the leg is inserted, this spring slides over stops cast upon the flanges on the bottom plate of the stove, which hold the leg in place. The leg cannot then be drawn out till the ends of the spring are raised above the stops.

FLAX BREAK.—Masa Branch Southwick, of Mont St. Hillaire, Canada.—The inventor employs rollers having rigid cogs, with angular denticulated surfaces which intermesh and break the straw of flax, hemp, etc., when the latter is passed through between the revolving rollers.

SULEY HARROW.—Frederick P. L. Reimers, and Hans Asbahr, of Davenport, Iowa.—This is an arrangement of a rising and falling harrow with the frame of a two wheeled vehicle upon which the driver sits; the central bars of the harrow being caused to reciprocate through the action of shafts, cranks, and connecting rods actuated by bevel gearing from the wheels of the vehicle.

CULTIVATOR.—Newton J. Harris, of Meredosia, Ill.—This is a novel combination of a frame with plow beams in combination with a lever and a perforated bar for adjusting the plows. The plows may be also adjusted so as to work near to or far from the rows, as may be desired.

CORN HARVESTER.—John Crossland, of Spencer Grove, Iowa.—This machine consists of a frame on wheels, carrying a sickle or cutter, and spring bars to gather the corn together, as it is cut, and hold it on the frame till enough to form a "shock" has been collected. The horse travels on the right side of the center of the frame, the thills being pivoted to the right of the center, so that the horse travels between the rows when the cutter is brought into proper position. The driver sits on a seat upon the frame, and removes the shocks as they are gathered.

MEDICAL COMPOUND FOR LIVER AND OTHER DISEASES.—Cicero A. Simmons, of Waldo, Florida.—This compound is composed of a number of officinal drugs prepared in a peculiar manner, and, it is claimed, produces a healthy action upon the liver, stomach, and kidneys, and is a most valuable medicine in the treatment of all bilious affections.

CARROUSEL.—Wilhelm Schneider, of Davenport, Iowa.—This invention relates to a new arrangement of "carrousel" or rotary pavilion used in public parks and other places of amusement, and has for its object to provide ample accommodation for occupants, a substantial mode of construction, and a convenient method of guiding it during motion. The invention consists in making the carrousel in two stories, and in providing a staircase within the central supporting frame to enable persons to reach the second story.

WHEELED VEHICLE.—This invention has for its object to provide means for reducing the draft of wheeled vehicles, and consequently lessening the wear and tear of the rolling gear and the fatigue of the draft animals. It consists in the application to the under side of a wagon or other vehicle of a pivoted frame carrying a grooved wheel which can be let down to run on a single rail and relieve the outer wheels from the main weight. The entire load is thereby more evenly balanced and transferred from a broad to a narrow base.—James F. Cass, of L. Original, Canada, is the inventor.

FIRE PLACE.—This invention provides a hollow fire-back for grates whereby a liberal supply of air will be carried from beneath the grate to the perforated back of the same, to furnish oxygen to the first products of combustion, and obtain a more perfect secondary combustion. The invention consists in the formation on the inner corners of the fire-back of lower air entrances, which are above the ash pan, and serve to convey air to the upper hollow perforated back of the fire place. These air entrances are produced by means of concave corners formed on the back above the square corners of its support, and do therefore not interfere with the grate nor take away any useful space behind the same. They extend down nearly, but not quite, to the ash pan, so that the latter may be of rectangular form. The invention consists, also, in forming projecting ears at the front upper corners of the fire back, which define the width of the throat to the flue and aid in keeping the tile in place. Joseph Hackett, of Louisville, Ky., is the inventor.

IMPROVEMENT IN SHIP BUILDING.—Edward M. Strange, of New York city.—This invention consists in a modeling of the submerged portion of the hulls of vessels on a circular or other equivalent form around the axial line of the center of displacement, the said circular or other form beginning amidship or thereabout, and tapering on fine lines to a point on each end, the object being that the lifting tendency of the water on the lower planes shall be neutralized by the impact on the upper planes of the said circular or other form, and the displacement caused to commence at the center of resistance, and operate in all directions, or nearly so, to avoid emersion, thereby causing the stationary and traveling load line to be the same, so that all the weight of ship and cargo will be wholly sustained by the water, and the engines relieved of any lifting tendency, and their whole power utilized for speed or displacement.

LIFTING MACHINE.—This is a new machine for lifting purposes, for testing the power of persons to lift heavy weights and developing the muscular system. It consists in a frame of two or more pairs of parallel bars pivoted near one end, and carrying heavy cylinders which may be easily rolled along the tops of the bars from one to another of the notches arranged along the upper edges of the bars at equal distances apart, and having the gravity indicated in pounds by figures at each notch, which, the weights resting therein, will represent when the frame is lifted at the fore end.—Cicero A. Simmons, of Waldo, Florida, is the inventor.

FEED APPARATUS FOR MILLSTONES.—Alvah Dewey, of Princeton, Ky.—This invention relates to improvements in the feed apparatus of millstones in which the upper and running stone is suspended on a tube by which it is rotated, and another tube, which does not revolve, is employed for conducting the grain down through the first to a short distance above the bed-stone; and it consists in the combination, with this conducting tube, of a disk or plate which is secured in the enlarged eye of the runner, and has for its office to spread the grain and facilitate its passage between the surfaces of the stones.

FENCE.—Samuel S. Porter, of Broad Ford, Pa.—Bed pieces rest upon the ground, in the top of which a "gain" is cut to receive the bottom ends of the posts. The posts of the panels stand up in the gain of the bed piece in contact with each other, and are fastened together by a bolt. When the ground is undulating, the posts will separate at either top or bottom, and the bolt must be of a length to correspond. The braces are made to extend below the bed piece and enter the ground. Their upper ends are secured to the posts by the same bolt that holds the posts together. By removing the bolt the panels, as well as the braces and bed pieces, are left free, and may be removed without trouble, and in practice it is necessary to fasten the braces to the bed pieces in some manner. It is claimed that by the above construction and arrangement of parts a most durable and substantial fence is made, requiring very little labor either to construct and prepare the different parts or to put it down.

CORN-PLANTER.—James A. Knetzer, Fillmore, Ind.—This invention relates to an apparatus for planting corn by means of cans, for containing the seed, affixed to the side of a wheel, from which cans the corn is conducted in proper quantities through spouts to the deliveries at the perimeter of the wheel.

PLATE COATED SHINGLE AND COMPOUND FOR THE COATING.—Thomas J. Langley, East Cambridge, Mass.—This invention consists in a new compound for coating wooden shingles, whereby they are prevented from decaying, rendered fire and water proof, and caused to assume the appearance of slate shingles, without possessing their weight or brittleness, besides being produced at much less cost.

COMBINED STEAM AND WATER MOTOR.—John McGowan, Lebanon Church, Pa.—This invention has for its object to produce the revolution of a wheel by means of a jet of water thrown against the buckets of the wheel, the impulsion of the water being caused by the production of a vacuum within the case in which the wheel is enclosed, which vacuum the water rushes in to fill, and the vacuum being produced by the condensation, through contact with the water of steam which is injected into the case.

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117,499.—WASHING MACHINE.—J. H. Adams, Montana, Iowa.
117,500.—LAMP.—E. D. Ashe, Brompton, England.
117,501.—AWL.—Samuel Babbitt, Brazil, Ind.
117,502.—SEED PLANTER.—B. Baker, Hopkinton, Iowa.
117,503.—MOTION.—E. H. Bancroft, Syracuse, N. Y.
117,504.—MOTOR.—A. Barbarin, J. Albrecht, N. Orleans, La.
117,505.—MOTOR.—A. Barbarin, J. Albrecht, N. Orleans, La.
117,506.—HAT VENTILATOR.—S. Beatty, Norwalk, Conn.
117,507.—TREATMENT OF PIG IRON.—H. Bessemer, London, Eng.
117,508.—HORSESHOE.—A. T. Boon, D. M. Orsborn, G. Geer, Galesburg, Ill.
117,509.—CHAIR.—H. E. Braunfeld, Philadelphia, Pa.
117,510.—POWDER BOX.—B. F. Brown, Boston, Mass.
117,511.—LEAF TURNER.—A. W. Bush, M. McComb, St. Cloud, Min
117,512.—OIL CLOTH.—T. Carson, Brooklyn, N. Y.
117,513.—LATHE.—E. G. Chormann, Philadelphia, Pa.
117,514.—HARVESTER.—C. Clapp, Trumansburg, N. Y.
117,515.—SAD IRON HOLDER.—W. B. Coates, Philadelphia, Pa.
117,516.—HORSE POWER.—John F. Collins, Lodi, Miss.
117,517.—NUT LOCK.—J. M. Connel, Newark, Ohio.
117,518.—BATTLEDOOR.—M. Cregen, Chicago, Ill.
117,519.—GENERATOR.—Edwin Day, Rockford, Ill.
117,520.—WINDOW SHADE.—W. Devine, Philadelphia, Pa.
117,521.—FEED CUTTER.—C. R. Donner, Sonora, Cal.
117,522.—WATER WHEEL.—F. C. Doran, Benj. F. Sortman, Knightstown, Ind.
117,523.—DROP BOX.—John Dyson, Philadelphia, Pa.
117,524.—CULTIVATOR.—Daniel Edelman, Madison, Ind.
117,525.—PRUNING SHEARS.—C. H. Eggleston, Marshall, Mich.
117,526.—SEWING MACHINE.—J. V. D. Eldredge, Detroit, Mich.
117,527.—BOLT.—P. Eley, New York city.
117,528.—CARPET STRETCHER.—S. Elliott, Sonora, Cal.
117,529.—HANGING PICTURES.—A. A. Fielding, Boston, Mass.
117,530.—GLOVE FASTENER.—M. B. Foote, Northampton, Mass.
117,531.—GRAIN SPOUT.—John O. Frost, Candor, N. Y.
117,532.—STOVE.—S. J. Gold, Cornwall, Conn.
117,533.—LOOM.—R. B. Goodyear, Wilmington, Del.
117,534.—COAL HOISTER.—J. Green, New York city.
117,535.—ROLLING STOCK.—J. W. Grover, Westminster, Eng.
117,536.—BARREL HEAD.—A. Hanvey, Steubenville, Ohio.
117,537.—MEDICAL COMPOUND.—R. Hawkins, A. A. Hill Beallsville, Pa.
117,538.—MITER BOX.—G. E. Hedges, Ashland, Neb.
116,539.—BEEHIVE.—W. M. Henry, Leo, Ind.
117,540.—MORTAR MILL.—S. H. Hinsdell, Camillus, N. Y.
117,541.—HAY FORK.—Jacob Huy, Bakerstown, Pa.
117,542.—AUGER.—W. W. Jilz, Hamilton, Mo.
117,543.—CARPET BEATER.—T. Jordan, Brooklyn, and W. H. Jordan, New York city.
117,544.—OIL CAN.—M. S. Kavanagh, Detroit, Mich.
117,545.—GRAIN SEPARATOR.—E. L. Kelly, Reading, Mich.
117,546.—PIPE COUPLING.—F. Kibler, Baltimore, Md.
117,547.—CULTIVATOR.—H. P. Kynett, Lisbon, Iowa.
117,548.—GOVERNOR.—C. M. Langley, Lowell, Mass.
117,549.—STILL.—A. K. Lee, Galveston, Tex.
117,550.—TREMOLO.—John R. Lomas, New Haven, Conn.
117,551.—BRICK MACHINE.—W. H. and H. P. L. Machen, Jr., Toledo, Ohio.
117,552.—FIREARM.—J. Manton, Montreal, Canada.
117,553.—CAR SEAT.—M. M. Martin, Cochran, Ind.
117,554.—WASHING MACHINE.—J. Matthias, New York city.
117,555.—CHIMNEY.—S. M. McCord, Springfield, Ohio.
117,556.—SPINDLE.—A. Morton, Salmon Falls, N. H.
117,557.—SEWING MACHINE.—H. Moschcowitz, New York city.
117,558.—BEARING.—Eliza D. Murfey, New York city.
117,559.—TOY.—S. Patterson, Newark, N. J.
117,560.—HORSESHOE NAILS.—C. H. Perkins, Providence, R.I
117,561.—HAY TEDDER.—John G. Perry, Kingston, R. I.
117,562.—HAY TEDDER.—John G. Perry, Kingston, R. I.
117,563.—HOSE CLASP.—T. J. Pettit, Brooklyn, N. Y.
117,564.—BUTTON.—G. W. Phillips, Fresh Pond, N. Y.
117,565.—CHAIR AND BED.—J. F. Pitcher, Louisville, Ky.
117,566.—GRIPER.—T. J. Plunket, New York city.
117,567.—BORING MACHINE.—W. P. Powers, N. LaCrosse, Wis.
117,568.—DISH WASHER.—H. C. Robertson, E. Saginaw, Mich.
117,569.—GENERATOR.—H. M. and J. F. Rulon, Monmouth, Ill.
117,570.—VALVE GEAR.—H. See, Pottsville, Pa.
117,571.—BLOW OFF.—N. Sherman, Cincinnati, Ohio.
117,572.—REFRIGERATOR.—B. F. Smith, New Orleans, La.
117,573.—ROCK DRILL.—Hugo Sontag, Osnabrück, Germany
117,574.—PLOW.—P. H. Starke, Richmond, Va.
117,575.—ROUNDING LEATHER.—Le Roy A. Sweatt, San Francisco, Cal.
117,576.—BLAST FURNACE.—F. D. Taylor, Brady's Bend, Pa.
117,577.—CAN.—J. Taylor, Petroleum Centre, Pa.
117,578.—FLUTING MACHINE.—C. W. Thompson, Chicago, Ill.
117,579.—TELLURIAN.—Joseph Troll, Belleville, Ill.
117,580.—MOVEMENT CURE.—D. Wark, Montreal, Canada.
117,581.—LUBRICATOR.—H. S. Weaver, Irwin Station, Pa.
117,582.—TRIMMING JACK.—J. Webb, Jr., Portland, Me.
117,583.—HAIR DYE.—J. J. Wild, Bay city, Mich.
117,584.—HORSE SHOE NAIL.—H. A. Wills, Vergennes, Vt.
117,585.—HEATER.—W. E. Wood, Baltimore, Md.
117,586.—MOLDING MACHINE.—J. A. Woodbury, Boston, Mass.
117,587.—ORGAN.—G. W. Woodruff, Hartford, Conn.
117,588.—RIPPING TOOL.—J. O. Woods, New York city.
117,589.—SLICING CANDY, ETC.—J. P. Anderson, Phila., Pa.

117,590.—PRUNING SHEARS.—G. W. Ancsley, Marengo, Mich.
117,591.—PEAT WRINGER.—A. N. N. Aubin, Portland, Conn.
117,592.—FLAT IRON.—A. Bachelder, Pelham, N. H.
117,593.—HAND STAMP.—E. H. Barney, Springfield, Mass.
117,594.—AUGER BIT.—C. W. Beals, Greig, N. Y.
117,595.—HARROW.—J. Benson, Belle Plains, Iowa.
117,596.—SEWING MACHINE.—L. R. Blake, Fort Wayne, Ind.
117,597.—BEARING.—M. Briggs, Rochester, N. Y.
117,598.—SIGNAL.—D. W. Brown, C. A. Campbell, Woodbridge, N. J.
117,599.—CAR SEAT.—C. S. Buck, J. Lovett, St. Louis, Mo.
117,600.—CATTLE GUARD.—C. Caton, Boyd's Mills, Ohio.
117,601.—ROOFING.—C. W. Chaffee, Des Moines, Iowa.
117,602.—GAS PIPE SEAL.—R. B. Chapman, Waltham, Mass.
117,603.—WASHING MACHINE.—J. M. Clark, Lancaster, Pa.
117,604.—SEWING MACHINE.—A. F. Colby, Bath, Me.
117,605.—ROOFING.—I. D. Cook, Normal, Ill.
117,606.—WASTE COCK.—W. S. Cooper, Phila., Pa.
117,607.—CORN SHELLER.—H. W. Cornell, Owego, N. Y.
117,608.—PLOW.—S. A. Cummins, Vienna, N. J.
117,609.—MALLET.—J. B. Davids, New York city.
117,610.—GAS RETORT.—D. Davison, New York city.
117,611.—CUTTER.—W. S. Deeds, Baltimore, Md., J. P. Bradway, Phila., Pa.
117,612.—QUILL FOR SILK.—I. Dimock, Boston, Mass.
117,613.—GENERATOR.—S. W. Emery, E. P. Doyen, Portland, Me.
117,614.—BRUSH.—A. Fischer, New York city.
117,615.—REAMER.—W. Forker, Rockland, Pa.
117,616.—LOOM.—J. G. Frick, Pottsville, Pa.
117,617.—TEA KETTLE.—J. Gibson, Jr., Albany, N. Y.
117,618.—OX-BOW PIN.—I. Glover, Newtown, Conn.
117,619.—DASH BOARD.—H. I. Godwin, Windsor, N. C.
117,620.—DYE.—F. Graupner, Evansville, Ind.
117,621.—RAZOR STROP.—W. M. Green, Gallatin, Tenn.
117,622.—HEDGE PLANTER.—N. L. Griffith, So. Plymouth, O.
117,623.—SCYTHE.—C. Hamler, Newton, N. J.
117,624.—ROOFING BRACKET.—W. Hancock, Gosport, Ind.
117,625.—TRUNK.—T. Hanvey, Elma, N. Y.
117,626.—AIR PUMP.—J. F. Haskins, Fitchburg, Mass.
117,627.—BOOT, ETC.—J. W. Hatch, Rochester, N. Y.
117,628.—FLUID METER.—H. B. Hebert, New York city.
117,629.—CHURN.—H. Hensel, Moon township, Pa.
117,630.—CLOTH BEAM.—J. P. Hillard, Fall River, Mass.
117,631.—GAS RETORT.—S. Holman, London, England.
117,632.—DESK AND BED.—F. Hopf, Chicago, Ill.
117,633.—DESK.—A. O. Huffman, Springfield, O.
117,634.—PEAT ELEVATOR.—E. James Hulbert, A. N. N. Aubin, Portland, Conn.
117,635.—SLOP HOPPER.—J. G. Ils, San Francisco, Cal.
117,636.—WASHING MACHINE.—E. Jennings, Sherman, N. Y.
117,637.—WAGONS.—J. Jensen, Racine, Wis.
117,638.—VELOCIPEDE.—S. Johnson, West Croydon, Eng.
117,639.—HARVESTER.—W. N. Johnson, Oxford, Wis.
117,640.—SEWING MACHINE.—J. T. Jones, Ilion, N. Y.
117,641.—OIL PRESS.—A. Judson, Newark, N. J.
117,642.—STOVE PIPE CLEANER.—J. F. Kellogg, N. Bridgewater, Mass.
117,643.—PARLOR SKATE.—D. Kerr, A. E. Hovey, San Francisco, Cal.
117,644.—SEWING MACHINE.—J. Kimball, Boston, Mass.
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REISSUES.

4,490.—SUPPORT.—W. Beers, Milan, Ohio.—Patent No. 115,016, dated May 23, 1871.
4,491.—CARTRIDGE.—H. Berdan, New York city.—Patent No. 82,587, dated Sept. 29, 1868.
4,492.—OIL TANK.—J. Brundred, Oil City, Pa.—Prtent No. 110,953, dated Jan. 17, 1871.
4,493.—SIGNAL INSTRUMENT.—T. S. Hall, West Meriden, Conn.—Patent No. 97,505, dated Dec. 7, 1869.
4,494.—VENTILATOR.—M. T. Hitchcock, Springfield, Mass.—Patent No. 74,534, dated Feb. 18, 1868; reissue No. 4,005, dated May 31, 1870.
4,495.—FRUIT DRYER.—J. P. Miller, Somerville, N. J.—Patent No. 109,234, dated Nov. 15, 1870
4,496.—FIREARM.—W. H. Morris, New York city, C. L. Brown, Sing Sing, N. Y.—Patent No. 26,919, dated Jan. 24, 1860.
4,497.—WASHING MACHINE.—S. W. Palmer, C. Coventry, Auburn, N. Y.—Patent No. 40,330, dated Oct. 20, 1863.
4,498.—STOCK CAR.—A. Rank, H. King, and J. Sharp, Salem, Ohio.—Patent No. 111,573, dated Feb. 14, 1871.
4,499.—GRAIN DRILL.—L. Wight, Whitewater, Wis.—Patent No. 112,663, dated March 14, 1871.
4,500.—PRESSER, ETC.—A. S. Woodward, Brooklyn, N. Y.—Patent No. 110,945, dated Jan. 10, 1871.

DESIGNS.

5,146.—STEAM ENGINE.—C. M. Farrar, Buffalo N. Y.
5,147.—SETTEE.—J. W. Fiske, New York city.
5,148.—CASTER.—J. L. Haven, Cincinnati, Ohio.
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5,151.—SHOE CLASP.—G. Oldham, Youngstown, Ohio.
5,152 to 5,154.—FLOOR CLOTH.—C. L. Pierpont, Salem, N. J.
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415.—JEWELRY.—J. P. Turner, Birmingham, England.

EXTENSIONS.

SAWING MILL.—W. M. Ferry, Grand Haven, Mich.—Letters Patent No. 17,829, dated July 21, 1857; reissue No. 542, dated April 6, 1858.

RETORT COVER.—J. R. Floyd, New York city.—Letters Patent No. 17,854, dated July 21, 1857.

BRIDGE.—G. H. Hulskamp, New York city.—Letters Patent No. 17,898, dated July 21, 1857.

SEAMING SHEET METAL ROOFS.—J. B. Prouty, Cincinnati, Ohio.—Letters Patent No. 17,874, dated July 28, 1857; reissue No. 889, dated Jan. 24, 1860.

CAPSTAN.—C. Perley, New York city.—Letters Patent No. 17,940, dated August 4, 1857; reissue No. 1,345, dated Oct. 7, 1862.

FACTITIOUS IVORY.—W. M. Welling, New York city.—Letters Patent No. 17,949, dated August 4, 1857.

APPLICATIONS FOR EXTENSION OF PATENTS.

METALLIC SCREW CAP FOR JARS, ETC.—John K. Chase, New York city, has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

PRINTING MACHINE.—Samuel W. Francis, Newport, R. I., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

MAKING IRON SPOONS.—G. I. Mix, Yalesville, Conn., has petitioned for an extension of the above patent. Day of hearing, October 11, 1871.

PILE FOR ROLLING BEAMS.—John Griffin, Phœnixville, Pa., has petitioned for an extension of the above patent. Day of hearing, November 15, 1871.

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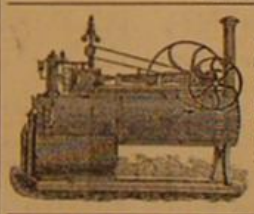

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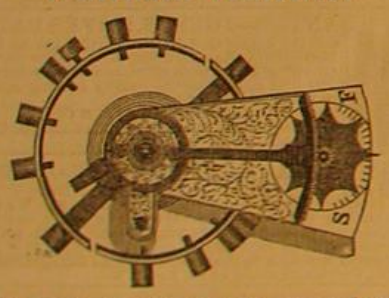

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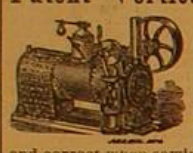

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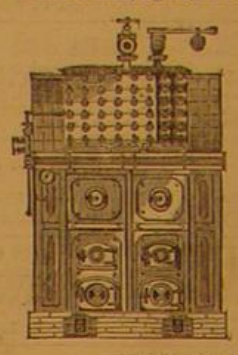

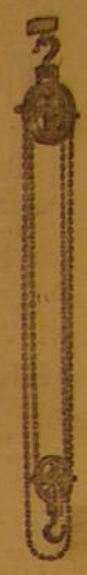

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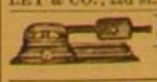

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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FILE CUTTING.

Our artist has, this week, prepared an engraving of one of the most interesting and important handicraft operations, namely, that of file cutting. Before, however, we call special attention to this part of the manufacture of files, it will be best to say something of the forging of files.

In the manufacture of files, the steel must be of good quality and highly converted; for if too soft or unequal in texture, the file itself would soon be worn down instead of the surface upon which it is intended to operate; if, on the contrary, it be too hard, the teeth become brittle and chip off at every stroke.

In forging files coke is preferred as the fuel. The striker is furnished with a large double handed hammer, with a broad face at either end; but the hammer wielded by the maker is smaller and single handed, somewhat conical in shape, the wider end forming the face.

Three-square and half round files are forged in grooved bosses or dies fixed in the anvil. The rod of steel being raised to the proper heat, which ought not to exceed a blood red, the end is hammered until it fills the die; the maker holds the die, and strikes with the small hammer; the striker standing before the anvil deals powerful blows on the heated metal, the flat faces of the hammers covering a considerable portion of the surface of the blank file at each stroke, expanding and leveling it at one operation. When the blank has been forged to the proper length, the tang is also drawn out by cutting into the blank a little on both sides with a chisel, so as to form in many cases sharp square shoulders, and then drawing out the part so cut to form the tang. The maker's mark or monogram is then stamped on. Blanks for round files are formed in a slightly conical swage; blanks for flat and square files are formed by hammering. The maker accustoms himself, as much as possible, to the forging of one description of file, in order that by the concentration of his skill and attention on one article he may attain perfection in its manufacture.

The forged blanks are carefully annealed, or lighted, in order to make the metal soft enough for cutting the teeth. Blanks for common files are softened in an ordinary annealing oven, but the best blanks are protected from the action of the air by being buried in sand contained in an iron box; this is slowly raised to the proper heat, which, as in the forging, ought not to exceed a blood red.

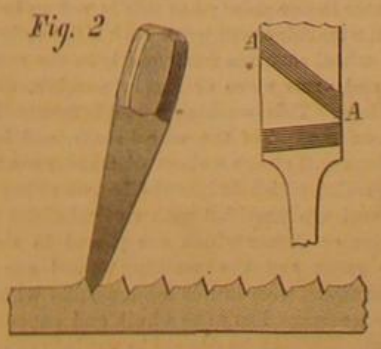
The surfaces of the blanks are next made accurate in form and clean in surface by stripping or grinding. In Sheffield, all the blanks above a certain magnitude are ground on large grindstones. In a few cases, as in dead parallel files, the blanks are planed in the planing machine. The blanks are slightly greased preparatory to being cut.

A few years ago, Dr. Tomlinson, author of the "Cyclopædia of Useful Arts," witnessed the operation of file cutting at the establishment of Messrs. Beardshaw, Stevenson & Co., of Sheffield. His description is so admirable that we cannot do better than to adopt it on the present occasion:

"It is scarcely possible to examine attentively the teeth of a fine file without being struck with their beauty and regularity; but how greatly is our admiration increased when we know that these teeth are cut singly with a hammer and chisel, the workman having no other guide than delicacy of touch and precision of eye, depending however rather upon the former sense than the latter! The cutting room is a long narrow apartment with a range of windows in front, opposite which are placed a number of low stone benches for the anvils, and seats for the workmen. The hammers weigh from one to six pounds each, according to the size of the file; they are curiously formed, the handle being so placed as to allow the mass of metal to be pulled toward the workman while making the blow. The chisels are formed of good tough steel, and also vary with the size of the file; they are somewhat broader than the file to be cut, and are sharpened to the proper angle; they are only just long enough to be held between the fingers and thumb somewhat as a pen is held, only in the left hand, the hollow of the hand being turned to the workman. But the peculiar method of handling the chisel depends in great measure on the kind of tooth to be cut. The file is held to its place on the anvil by means of a leather strap passing over each end of the file, and then under the feet of the workman in the manner of stirrups. At every blow of the hammer the chisel is made to cut a tooth, and the blows follow each other in rapid succession, the workman after every blow advancing the chisel forward by so slight a movement as to be scarcely perceptible. The chisel forms a

FILE CUTTERS AT WORK.

Fig. 2



number of angular grooves parallel to each other, the tooth being formed by the metal left between every two grooves. The skillful workman adjusts the weight of his blow to the kind of metal he is operating upon; and even in the same file, if one part be softer than another, he adapts the weight of his blow so that the teeth may be of the same size in every part. As the work proceeds he gradually shifts the file forward by loosening his tread upon the straps. When one surface is covered with single cuts, he proceeds, in double cut files, to add a second row of teeth, making them cross the first at a certain angle, for which purpose the chisel requires to be held in a particular manner. When one side is covered, he proceeds in like manner to fill a second side; but as the teeth just finished would be injured by placing them on the naked anvil while hammering, they are protected by interposing a flat piece of an alloy of lead and tin, which completely preserves the side already formed. Similar pieces of alloy with angular and rounded grooves are used in cutting triangular and half round files. Rasps, as already noticed are cut with a triangular punch instead of a chisel, every new tooth being placed opposite a vacant space in the adjoining row of teeth.

"The curved surfaces of files show in a remarkable way the skill of the file cutter; in them the teeth are formed with straight edged chisels, many rows of short cuts being made from the top to the bottom of the file; and these cuts, uniting together at their extremities, thus form a complete series of lines, passing completely round the cylinder or half cylinder, as the case may be. In fine round files, as many as from ten to twenty rows or cuts are required to cover the surface with teeth; and when it is considered that there may be upwards of a hundred teeth within the space of an inch, some idea may be formed of the many thousand blows required to raise the teeth on a fine file. In double cut files, when one row of teeth is completed, a fine file is run slightly over them, and the surface is greased to moderate the roughness before commencing the second row."

In some of the double cut gullet tooth saw files, as many as twenty-three courses are sometimes used for the convex face, and only two courses for the flat one. The half round and round files are usually cut by apprentice boys, the narrow cuts being less difficult than the broad ones. It might be supposed that all this labor might be saved by using chisels curved to the proper section, instead of straight ones; this plan has been tried, and found to be quite impracticable.

Mr. Holtzapffel describes the operation of cutting in the following terms: "The first cut is made at the point of the file; the chisel is held in the hand at a horizontal angle of about 55° with the central line of the file, as at A, Fig. 2, and with a vertical inclination of about 12° to 14° from the perpendicular, as there represented, supposing the tang of the file to be on the left hand side.

The blow of the hammer upon the chisel causes the latter to indent and slightly to drive forward the steel, thereby throwing up a trifling ridge or burr; the chisel is immediately replaced on the blank and slid from the operator, until it encounters the ridge previously thrown up, which arrests the chisel or prevents it from slipping further back, and thereby determines the succeeding position of the chisel. The heavier the blow, the greater the ridge, and the greater the distance from the preceding cut at which the chisel is arrested. The chisel having been placed in its second position, is again struck with the hammer, which is made to give the blows as nearly as possible of uniform strength; and the process is repeated with considerable rapidity and regularity, sixty to eighty cuts being made in one minute, until the entire length of the file has been cut with inclined, parallel, and equidistant ridges, which are collectively denominated the first course. So far as this one face is concerned, the file, if intended to be single cut, would be then ready for hardening, and when greatly enlarged its section would be somewhat as in Fig. 2. Most files, however, are double cut; that

is, they have two series or courses of chisel cuts. In cutting the second course, the chisel is inclined vertically as before, at about 12°, but only a few degrees horizontally, or about 5° to 10° from the rectangle, as shown in Fig. 2. "The blows are now given a little less strongly, so as barely to penetrate to the bottom of the first cuts, and from the blows being lighter they throw up smaller burrs, consequently the second course of cuts is somewhat finer than the first. The two series, or courses, fill the surface of the file with teeth, which are inclined towards the point of the file, and when highly magnified, much resemble in character the points of cutting tools generally; for the burrs which are thrown up and constitute the tops of the teeth are slightly inclined above the general outline of the file, minute parts of the original surface of which still remain nearly in their first positions. Taper files require the teeth to be somewhat finer towards the point, to avoid the risk of the blank being weakened or broken in the act of its being cut, which might occur if as much force were used in cutting the teeth at the point of the file, as in those at its central and stronger part."

The files are next hardened before they are fit for use. Some descriptions, however, such as are used upon wood, ivory, and other soft substances, are not hardened; such files admit of being sharpened up with a hand file. Some of the curved files used by sculptors and die sinkers are made of iron and case hardened.

Alvan Clark and his Telescopes.

Just at the end of the Brookline bridge, in Cambridge, Mass., stands a modest looking brick building that most persons would not consider worthy of a second glance, if indeed it attracted their attention; and near this building is another surmounted by a dome. These form the establishment of Alvin Clark, who has a world-wide reputation as a builder of telescopes, and also as an amateur astronomer.

Mr Clark was originally a miniature painter, and quite a successful one, as many paintings still in his possession prove. Some years ago his attention was accidently called to the subject of telescope making, from a description given by one of his sons of the small telescope at Amherst college. After hearing this, Mr. Clark remarked that he could make a telescope, and accordingly went to work and made one. His first instrument proved so successful that he was encouraged to persevere. One of his friends remarked to him about this time, "Mr. Clark, if you wish to know how to make telescopes, you will have to go to the place where they are made." But Mr. Clark thought some things might as well be studied out as learned from another, and so persevered, and was soon enabled to retaliate upon his friend by telling him that he had learned how to make telescopes, independent of instructors.

His telescopes are the kind known as refracting. In these the principal parts are the field or object glasses, or objectives, as they are most frequently called, and the eye piece. The principal use of the objectives is to collect the rays of light coming from the object, and to form an image at the focus of the lens. This image is afterwards magnified by the eye piece.

On the perfection of this focal image depend to a great extent the power and capabilities of the instrument. It must be colorless, or at least have no fringes on the edges; it must also be sharp and well defined, and have a large amount of light thrown on it. The first two of these conditions may be filled with a glass of a comparatively small diameter, but in order to accomplish the third, the diameter must be increased to as great an extent as possible.

Mr. Clark's first telescopes were distinguished for their freedom from chromatic and spherical aberration, as the first two errors are called, and latterly he has been devoting his time more especially to increasing the size of the glasses.

In order to correct the chromatic aberration, the objective is made of two disks of glass. The first of these, or the convex lens, is made of crown glass. This alone would form an image at the focus, but the image would be fringed with the colors of the spectrum. In order to prevent this, a concavo-convex lens, made of flint glass, is placed directly behind the first glass; this recomposes the white light which the first lens has decomposed, and forms an image at the focus that is almost perfectly colorless. In order to make it perfectly colorless, we should have to use more than two lenses.

There still remains the spherical aberration to be corrected. This is owing to several causes. In the first place, it may be that the glass is a little more dense on one side than on the other; this will serve to distort the image somewhat, and must be corrected by proper grinding. Then a portion of the glass may polarize light while another portion does not; this must also be corrected by grinding.

In order to test the glasses for these errors, they are placed on a carriage and run into a long tunnel which has a small spot of light at the further end. If now the eye be placed at the focus of the lens, a sharp clear image of the spot will be seen, provided the lens is perfect; otherwise it will be distorted and colored. It must also, when examined with a Nicol's prism, still remain free from color. If this is not the case, the glass is removed, repolished, and the test is repeated.

In order to grind the glasses, a coarse emery is first used, until they have been brought very nearly to the perfect form required. Then finer grades of emery are applied, and finally they are polished with rouge. The process takes a long time from the first arrival of the rough glass, until it becomes the finished objective. Almost the whole of the grinding is done by hand, on laps made of cast iron. These are used at first naked, and afterwards covered with pitch.

Telescopes are generally spoken of as being of so many inches aperture; and until within a very few years a telescope of fifteen inches aperture was regarded as enormous. In 1867, Mr. Clark constructed one of twenty inches aperture, for the observatory at Chicago. This at the time was the largest refracting telescope ever made. Since then one of twenty-four inches aperture has been made in England; and now the Messrs. Clark have orders for two of twenty-five inches aperture; one intended for the Government observatory at Washington, the other to go to Virginia.

These telescopes will be about twenty-five feet long when finished, the rule being that a telescope should be as many feet long as the objective is inches in diameter. Any one who wishes to indulge himself with one of these instruments as a toy, can do so at an expense of about $100,000, and there will most likely be a further expense of $50,000 in providing a place to keep it. These large telescopes are so nicely adjusted that a person can easily move them with a finger, although they weigh several tuns. Besides making telescopes, Mr. Clark has made a specialty of spectroscopes. He has constructed some very fine ones; among others that of Professor Young, to which we have alluded in the *Journal*. This instrument has been almost completely rebuilt, and some improvements suggested by experience have been added. Mr. Clark has also built a new telescope for Professor Young, of nine and one third inches aperture. This instrument has a steel tube, made of plates of steel riveted together, as it has been found that steel tubes can be constructed so as to weigh less and yet be stiffer than wooden ones.—*Boston Journal of Chemistry.*

Iron Telegraph Poles---An Invention Wanted.

Experience has shown that over large tracts of the Western territories, telegraph lines are daily exposed, at certain seasons of the year, to destruction from lightning. Certain circuits are, from this cause, interrupted to such an extent that they cannot be relied upon. A dozen or a hundred poles are shattered at a stroke, and a day is lost before connection can be restored. When telegraphic connection is first established and given to a people, irregularity is endurable, and patiently borne. But when attainable means of securing permanent intercourse with "the rest of mankind" begin to exhibit themselves, patience, having had her "perfect work," very properly demands release. So we have before us a cry from the Western plains for help, and in a direction where the means of supply seem abundant. The State of Missouri says to us, "my mountains are full of iron; your telegraph lines are shivered daily by bolts of lightning; I am exposed to isolation from my Pacific sisters; mold my iron into poles and plant them along the roads where the lightning reigns, and make a highway which shall be forever."

Now if this be the solution, there is wanted a design for an iron structure, and estimates of its cost. Many years ago we obtained such estimates, and published an article illustrated by a sketch of an iron telegraph pole, on which, curiously enough, was engraved the words "Pacific Telegraph." This was in 1853. That design embraced—

1. A foundation of stone, a single block five feet long and a foot square, planted firmly in the earth.

2. A neatly molded iron pole twelve feet high, terminating in a receptacle into which could be placed a wooden frame for the insertion of the insulators, and which could be removed for cleansing or repair at pleasure. This iron pole to be planted on the stone basis.

At that time such a line could have been provided at comparatively low rates, and the idea took possession of us as a future work when telegraph contractors being all well buried and happy, the pole had to be as permanent as the rail. That time seems to be coming. We invite attention to it. The foundation need not be stone. The top need not be wood, although we would suppose it best. Let us see whether in some simple style, in which taste and utility may blend, an iron highway can be provided over our Western territories to render communication at all times perfect and reliable.

We notice that Superintendent Tubbs has adopted the Varley plan of running a wire from the top of the poles on his exposed lines to the earth, to save them from destruction by lightning, with successful results.—*Journal of the Telegraph.*

Dish Washing Machine.

The object of this invention is to provide convenient means for cleansing dishes by machinery, thus saving much time and labor. A box is elevated so as to be of convenient height, preferably with a circular or inclined bottom, to conduct the water to one point; but this is not an indispensable feature, as the machine will work with a flat or level bottom. A washing wheel revolves transversely in the vessel, formed of a shaft and arms more or less in number, to which are attached wings. This washing wheel is revolved by means of a crank, on one end of the wheel shaft, and is placed so that the wings will sweep a short distance from the bottom. Removable racks, which fit into the box on either side of the washing wheel are provided with vertical slides for separating the plates or dishes which are placed in the machine. Above the racks and the washing wheel are removable trays, one or more, with lattice bottoms, and with slides constructed and arranged so as to admit and support any kind of dishes which it may be desired to put into the machine.

The inventor does not confine herself to any particular construction or arrangement of the racks or trays; but constructs them in such a manner that the space each side and above the wheel shall be utilized and the whole made convenient for placing in the machine and removing therefrom ordinary table dishes, and so that when placed in the machine they shall be exposed separately to the action of the water or suds employed in the washing process.

When sufficient quantity of hot water and soap has been placed in the machine and has been fastened down, the wheel is turned six or eight revolutions in either or both directions, when the water is drawn off through the orifice, and clean hot water is introduced and the wheel is again revolved. This completes the washing. The water is drawn off and the cover is raised, which allows the steam or vapor to escape. This soon dries the dishes and they are again ready for use. Harriet C. Robertson, of East Saginaw, Mich., is the inventor of this machine.

Combined Rubber and Copper Wire for Pipe Couplings.

Mr. FREDERICK KIBLER, of Baltimore, Maryland, has patented an improved joint for water pipes, steam pipes and steam chests, around bolts and other places, whether the joint be round, square, or of any other shape, which is claimed to be simple in construction and reliable and effective in use; it consists in a rubber or equivalent plate and copper wire for forming the joint. The plate made of rubber or other suitable material, is cut to fit between the faces that form the joint. Upon the plate is placed a copper wire, bent into a form corresponding with the hole or opening around which the joint is formed. The copper wire, which forms the real joint, should be one size larger than the thickness of the rubber plate, so that it may be flattened down between the faces of the joint, and may thus make the joint more perfect. This construction enables the wire to be arranged upon the rubber plate as may be desired, or so as to avoid flaws or imperfections in the plates or faces between which the joint is formed. If desired, two rubber plates may be used, with the copper wire placed between them.

Use of Silicate of Potassa in Strengthening Fossil Skeletons.

A very judicious application of the silicate of potassa has been lately made at the Museum of Natural History of Paris, in repairing a great many fossil skeletons which had been disseverated and broken by the shells bursting in this palace of science.

The solutions have been first used diluted to about 30° Beaumé, and afterwards of a higher degree of concentration. The adherence of the broken or separated pieces is brought together by applying with a brush some of the solution of silicate of potassa on the parts to be joined, then they are left to dry, and the joint is hardly visible; and the joined part is far stronger than the remainder of the bone. Very delicate and porous anatomical pieces, as skeletons of birds, insects, etc., can be dipped repeatedly in more diluted solutions, and thus be rendered very hard and tenacious.

The Manufacture of Albumen.

The enormous consumption of albumen, both for photographic purposes and the printing of textile fabrics with aniline colors, has led many chemists to search for means of producing it, other than by using the whites of eggs. As far as we know, all attempts to produce it synthetically have been failures. On page 89, Vol. XXII., we described the process of obtaining it from blood and from fish roes; and the latter source of supply has now been rendered more largely available by a new mode of treatment, devised by Herr Grüne, of Frankfort-on-Maine. The roes are rubbed, through a sieve, with a hard brush, leaving the cellular tissues behind. The liquid albumen runs through the sieve, and is left to settle in tall, upright vessels, after which it is poured into shallow pans and evaporated in drying chambers. Before evaporation, it should be filtered through sand. Albumen from the roes of fresh-water fish is fine and clear, and fit for immediate use; but that from sea fish will have an unpleasant odor, if the process be not done when the roes are quite fresh.

Gripers for Printing Presses.

Ordinary presses now in use are provided with gripers of a certain size and style. The same will answer for all ordinary purposes; but where one cylinder is used on a double-feeder press, as, for example, the oscillating cylinder on the well-known "Wharfedale," and registers two sets of gripers for holding the sheets alternately at opposite ends, such gripers are only useful for certain defined sizes of sheets, unless they are made adjustable. To thus make them adjustable is the object and result of an invention made by Thomas J. Plunket of New York, and assigned by him to Victor E. Mauger, also of New York.

The printing cylinder is provided with two sets of gripers, which are secured to vibrating rods and controlled in their motions, by cams or other suitable mechanism. The ordinary gripers are made to extend a suitable distance from the rods, to hold sheets of a suitable size. The improved gripers fit through perforated sleeves mounted upon the rods, or through apertures in said rods, and can be adjusted to suit the several sizes of papers to be held between them, and clamped by set screws or other means. Instead of being adjustable on the rods, the gripers may made in sections, so that the outer may be moved on the inner.

Improved Can for Nitro-Glycerin.

JACOB TAYLOR, of Petroleum Center, Pennsylvania, has patented an improved can for nitro-glycerin, wherein, it is claimed, nitro-glycerin and other explosive compound or material may be safely transported, and whence it can be conveniently removed for use. The invention consists on suspending the can by elastic bands or springs within an inclosing case or shell, the spring being so regulated that the can will always be kept clear of the shell during the oscillations and movements of handling and conveying. The contact of the can with any hard substance is thus avoided, and explosions from such causes consequently prevented.

The reduction of the public debt during the month of July was $8,701,976.

On the Gaseous and Liquid States of Matter.

A discourse was recently delivered at the Royal Institution, London, by Dr. Andrews, on the "Gaseous and Liquid States of Matter," from which we take the following:

The liquid state of matter forms a link between the solid and gaseous states. This link is, however, often suppressed, and the solid passes directly into the gaseous or vaporous form. In the intense cold of an arctic winter, hard ice will gradually change into transparent vapor without previously assuming the form of water. Carbonic acid snow passes rapidly into gas when exposed to the air, and can with difficulty be liquified in open tubes. Its boiling point, as Faraday has shown, presents the apparent anomaly of being lower in the thermometric scale than its melting point, a statement less paradoxical than it may at first appear, if we remember that water can exist as vapor at temperatures far lower than those at which it can exist as liquid. Whether the transition be directly from solid to gaseous, or from solid to liquid and from liquid to gaseous, a marked change of physical properties occurs at each step or break, and heat is absorbed, as was proved long ago by Black, without producing elevation of temperature. Many solids and liquids will for this reason maintain a low temperature, even when surrounded by a white hot atmosphere, and the remarkable experiment of solidifying water and even mercury on a red hot plate, finds thus an easy explanation. The term spheroidal state, when applied to water floating on a cushion of vapor over a red hot plate, is, however, apt to mislead. The water is not here in any peculiar state. It is simply water evaporating rapidly at a few degrees below its boiling point, and all its properties, even those of capillarity, are the properties of ordinary water at 96°·5 C. The interesting phenomena exhibited under these conditions are due to other causes, and not to any new or peculiar state of the liquid itself. The fine researches of Dalton upon vapors, and the memorable discovery by Faraday of the liquefaction of gases by pressure alone, finished the work which Black had begun. Our knowledge of the conditions under which matter passes abruptly from the gaseous to the liquid and from the liquid to the solid state may now be regarded as almost complete.

In 1822 Cagniard de la Tour made some remarkable experiments, which still bear his name, and which may be regarded as the starting point of the investigations which form the chief subject of this address. Cagniard de la Tour's first experiments were made in a small Papin's digester constructed from the thick end of a gun barrel, into which he introduced a little alcohol and also a small quartz ball, and firmly closed the whole. On heating the gun barrel with its contents over an open fire, and observing from time to time the sound produced by the ball when the apparatus was shaken, he inferred that after a certain temperature was attained the liquid had disappeared. He afterwards succeeded in repeating the experiment in glass tubes, and arrived at the following results. An hermetically sealed glass tube, containing sufficient alcohol to occupy two fifths of its capacity, was gradually heated, when the liquid was seen to dilate, and its mobility at the same time to become gradually greater. After attaining to nearly twice its original volume, the liquid completely disappeared, and was converted into a vapor so transparent that the tube appeared to be quite empty. On allowing the tube to cool, a very thick cloud was formed, after which the liquid reappeared in its former state.

"It is singular that in this otherwise accurate description Cagniard de la Tour should have overlooked the most remarkable phenomenon of all—the moving or flickering striæ which fill the tube, when, after heating it above the *critical point*, the temperature is quickly lowered. This phenomenon was first observed by the lecturer in 1863, when experimenting with carbonic acid, and may be admirably seen by heating such liquids as ether or sulphurous acid in hermetically sealed tubes, of which when cold they occupy about one third of the capacity. The appearances exhibited by the ascending and descending sheets of matter of unequal density are most remarkable, but it is difficult to give an adequate description of them in words or even to delineate them.

"These striæ arise from the great changes of density which slight variations of temperature or pressure produce when liquids are heated in a confined space above the critical point already referred to; but they are not formed if the temperature and pressure are kept steady. When seen they are always a proof that the matter in the tube is homogeneous, and that we have not liquid and gas in the presence of one another. They are, in short, an extraordinary development of the movements observed in ordinary liquids and gases when heated from below. The fact that, at a temperature 0°·2 above its critical point, carbonic acid diminishes to one-half its volume from an increase of only $\frac{1}{30}$ of the entire pressure, is sufficient to account for the marked characters they exhibit.

"If the temperature be allowed to fall a little below the critical point, the formation of cloud shows that we have now heterogeneous matter in the tube, minute drops of liquid in presence of a gas. From the midst of this cloud, a faint surface of demarcation appears, constituting the boundary between liquid and gas, but at first wholly devoid of curvature. We must, however, take care not to suppose that a cloud necessarily precedes the formation of true liquid. If the pressure be sufficiently great, no cloud of any kind will form.

A VERY cheap varnish must, of necessity, be dear at any price, for it is certainly more profitable to give the customer a varnish that will wear well, and save one's self the trouble and expense of repainting, thus doing two jobs for the price that should be received for but one.

Vinous Fermentation.

The following remarks are extracted from Dussauce's treatise on the "Manufacture of Vinegar," noticed in our last issue:

Vinous fermentation has been, from the earliest times, intrusted to inexperienced hands; it was only towards the end of the eighteenth century that chemistry began to explain it, and it is to the works of Fabroni, Legentil, Chaptal, Dandolo, etc., that it owes primarily the improvements it has received. In the act of alcoholic fermentation, all the ferment is not decomposed; indeed, it requires only 1½ part of dry ferment to transform 100 parts of sugar into alcohol. The carbonic acid gas, which is disengaged, carries with it some aqueous alcohol which marks 14°.

Lavoisier proved, by a direct experiment, that alcohol was due to the decomposition of sugar by a ferment. He took:—

Sugar	50.000 kilog.
Water	200.000 "
Yeast in paste	3.620 "
Dry yeast	1.375 "

When the fermentation was established, the new products were:—

Water	200.200 kilog.
Alcohol	28.250 "
Carbonic acid	17.300 "
Acetic acid	1.225 "
Undecomposed sugar	2.003 "
Dry yeast	0.674 "

If all the sugar had been decomposed, there would have been about 30 kilogrammes of alcohol.

M. Gay-Lussac has obtained from 50 kilogrammes of sugar:—

Alcohol	51.34
Carbonic acid	48.66
	100.00

Lavoisier thought that, in the vinous fermentation, a portion of the sugar was oxygenized at the expense of the other; and that one, more hydrogenated, formed alcohol, while the other was converted into carbonic acid, which was explained as follows: Sugar, like organic substances in general, is composed of carbon, hydrogen, and oxygen; in its decomposition, oxygen forms, with a part of the carbon, carbonic acid, and hydrogen, with the remaining carbon, produces alcohol.

M. Gay-Lussac, in his theory (*Ann. de Chimie*, vol. XCV.), supposes that sugar is composed of 40 parts of carbon, and 60 of water or its elements; if those weights are changed in volumes of each of the constitutive principles of this body, we obtain: –

Vapor of carbon	3 vols.
Hydrogen	3 "
Oxygen	3½ "

And we know that analysis has demonstrated that alcohol is composed of:—

1 vol. of bicarburetted hydrogen.	Vapor of carbon	2 vols.
	Hydrogen	2 "
1 vol. of vapor of water	Hydrogen	1 vol.
	Oxygen	½ "

From these elements of composition, omitting the weak products of the ferment, to consider only the alcohol and the carbonic acid, we find, by examining the composition of the sugar and that of the alcohol, that to produce that liquor, we must take from the sugar one volume of vapor of carbon and one volume of oxygen, which, by combining, produce one volume of carbonic acid gas, while the combination of the hydrogen and the other parts of the constituents of the sugar produce alcohol. According to this theory, if we reduce the volumes to weight, 100 parts of sugar, decomposed by the fermentation, are changed:

Into alcohol	51.34
" carbonic acid	48.66

Whatever probability there may be in this theory, it yet remains to determine what becomes of the nitrogen of the ferment, which is not mixed with the carbonic acid, nor is it a constituent principle of the white substance which is precipitated and is due to the decomposition of the ferment, nor of the small quantity of that very soluble substance which is found in the alcoholic product; however, it is certain that the carbonic acid and alcohol are both formed at the expense of the sugar.

This is a great question to solve. Is air necessary to the fermentation? In the affirmative we find a great chemist, whose name is the greatest authority. Gay-Lussac squeezed into a tube full of mercury, and well deprived of air, some grains of grapes; the fermentation would not begin until a little oxygen had been passed into it. M. de Fontenelle announced that, having filled with oil five bottles of 15 litres each, so as to remove the air adhering to the sides, he emptied them and immediately filled them with grape juice, covering this with a layer of oil about six inches thick, and that, notwithstanding the total privation of air, the fermentation began two days after; which would seem to prove that the pressure of the air is not an absolute necessity. In the above experiment, we believe the fermentation took place on account of the air contained in the juice. According to the calculations and the theory of M. Gay-Lussac, none of the elements of the air enter in the formation of the carbonic acid and alcohol, which are entirely due to the sugar. Moreover, he has himself ascertained that sugar and barley fermented very well without the contact of air (*Ann. de Chimie*, vol. LXXVI.); it is, therefore, easy to conclude that the quantity of alcohol ought to be in direct ratio with that of the saccharine matter.

Like grape juice, the different saccharine vegetable substances are susceptible of undergoing the vinous fermentation with or without the addition of ferment, provided they contain the nitrogenous substances necessary to perform the functions of a ferment. Thus, apple juice gives cider, that of pear, perry; and the saccharine matter developed in fermented and roasted barley, beer; honey and molasses, diluted with a sufficient quantity of ferment, result in a more or less strong alcoholic liquid.

Propulsion by Steam on Canals.

Among the large pile of letters on this subject with which our readers have favored us, is one from Mr. C. W. Hermance, of Schuylerville, N. Y., who gives his adherence to the ordinary screw propeller as the only suitable motor, not only on the ground of the large proportion of work done to power required, but also on account of the small and easily governed swell caused by that means of propulsion. He goes on to say that the modification of the box shaped boat, which is the form of all others adapted for the destruction of the canal banks, need not reduce the carrying capacity, nor necessitate the expense of reconstructing the boat. He suggests a false or adjustable bow, so formed as to make the displacement gradual, and which can be removed from the boat when it is passing through locks. He proposes to attach this bow to the vessel by a hinge so that the bow can be hauled up out of the water whenever necessity arises. The ease with which the bow can be elevated, and the obvious adaptability to boats now in use, are considered by Mr. Hermance as points in favor of his device. He claims, moreover, that one team of horses can tow a box shaped boat with his attachment faster than two teams can without it.

Mr. Hermance supplements this improvement of the boat's bow by boxing the screw to limit its lateral wash, and by making an opening, in the bottom of the boat, inclining upwards towards the screw; and states "that the direction given to the water, being forced up through the inclined space, has a tendency to carry it to the surface without injury to the canal structure." He invites criticism of and comments on his plan.

Another correspondent, Mr. A. S. Ellis, of Springfield, Ohio, suggests an iron tug, so constructed as to be attachable by means of ropes, to the bow of the boat; so that the tug will form a bow to the vessel, and must be large enough to contain the engine and the screw propeller. The canal locks would need enlargement, if the tug were not detached in passing through them, which latter could easily be done. By making a close connection between the tug and the boat, the rudder of the boat would be enabled to steer the compound vessel.

How Crude Rubber is Collected.

Greytown, Nicaragua, is the principal port for the export of india rubber on the coast. It is collected by parties of Indians, Caribs, or half cast Creoles, seldom by Europeans, to whom the dealers, who are also storekeepers, advance the necessary outfit of food, clothing, and apparatus for collecting rubber, on condition of receiving the whole of the rubber collected at a certain rate. The rubber hunters are termed *Uleros* (*Ule* being the Creole term for rubber). A party of Uleros, after a final debauch at Greytown, having expended all their remaining cash, generally make a start in a canoe for one of the rivers or streams which abound on the coast, and having fixed on a convenient spot for a camp, commence operations. The experienced rubber hunter marks out all the trees in the neighborhood. The rubber tree is the *Castilloa elastica*, which grows to a great size, being on an average about four feet in diameter, and from twenty to thirty feet to the first spring of the branches. From all the trees in the almost impenetrable jungle hang numerous trailing parasites, lianes, etc., from these, and especially the tough vines, are made rude ladders, which are suspended close to the trunks of the trees selected, which are now slashed by machetes in diagonal cuts from right to left, so as to meet in the middle and central channels, which lead into iron gutters driven in below and these again into the wooden pails. The pails are soon full of the white milk, and are emptied into larger tin pans. The milk is next pressed through a sieve, and subsequently coagulated by a judicious application of the juice of a Bejuca (an *Apocyna*?) vine. The coagulated mass is then pressed by hand, and finally rolled out on a board with a wooden roller. The rubber has now assumed the form of a large pancake, nearly two feet in diameter and about a quater of an inch thick, on account of which they are termed *tortillas* by the Uleros; these cakes are hung over the side poles and framework which supports the *rancho*, which is erected in the woods, and allowed to dry for about a fortnight, when they are ready to be packed for delivery to the dealer.

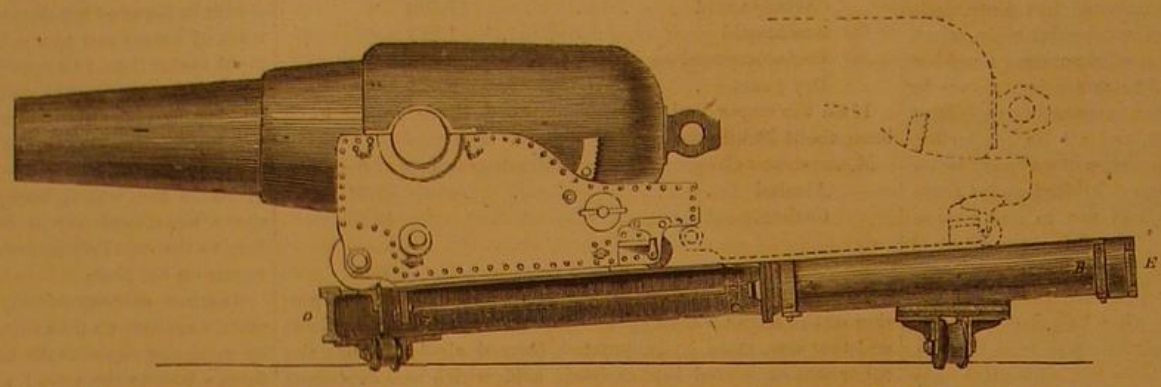
Why Circles Please the Eye.

Professor Müller, in a course of lectures in Berlin, offered a simple and mechanical explanation of the universal admiration bestowed on these curves. The eye is moved in its socket by six muscles, of which four are respectively employed to raise, depress, turn to the right, and to the left. The other two have an action contrary to one another, and roll the eye on its axis, or from the outside downward, and inside upward. When an object is presented for inspection, the first act is that of circumvision, or going round the boundary lines, so as to bring consecutively every individual portion of the circumference upon the most delicate and sensitive portion of the retina. Now, if figures bounded by straight lines be presented for inspection, it is obvious that but two or three muscles can be called into action; and it is equally evident that in curves of a circle or ellipse all must alternately be brought into action. The effect then is, that if two only be employed, as in rectilinear figures, those two have an undue share of labor; and by repeating the experiment frequently, as we do in childhood, the notion of tedium is instilled, and we form gradually a distaste for straight lines, and are led to prefer those curves which supply a more general and equable share of work.

HYDRAULIC BUFFER FOR CHECKING THE RECOIL OF HEAVY GUNS.

The ingenious instrument, the name, of which stands at the head of this paper, deserves some notice not only account of its utility for its purpose, but as an interesting method of meeting and overcoming those violent efforts of Nature to which she is provoked by explosion. In the recoil of a heavy gun, we have an example of the greatest force which man attempts to control. The inventions of Captain Moncrieff, which not long ago formed the subject of an article, seek to utilise this force; other gun carriages led it to expend itself as harmlessly as possible.

The hydraulic buffer accomplishes this latter object in a manner very ingenious, and affording some interesting illustrations of Nature's laws; it also possesses several advantages over other methods which have been and are still used. For it the public service is indebted to Colonel Clerk, R.A., F.R.S. Superintendent of the Royal Carriage Department in Woolwich Arsenal. Before the introduction of the hydraulic buffer into the English service, and in those cases where it is not yet applied, the method employed to overcome the recoil was the friction of iron plates. To the bottom of the gun carriage several plates are fixed, which pass between long plates placed along the middle of the slide or platform of which the carriage runs; and the friction of their surfaces in contact overcomes the force of the recoil, and brings the gun and carriage to a standstill. The amount of the friction can be regulated by the compression given to these plates, and requires to be altered for the various charges used. The compression must be taken off to allow the gun to be run forward to the fitting position, and must be again set up to meet the recoil. The hydraulic buffer, on the other hand, is always ready for use, and never needs any adjustment. This is one of its advantages, and one which is of special importance in the heat and excitement of action. It consists of a cylinder (A B in figure) placed in the platform, and lying along its length. In the cylinder is a piston pierced with four holes, and the extremity of the piston rod is attached to the carriage. When the gun and carriage are run out for firing, the piston is moved to the lower end of the cylinder (A) which is filled with water, except a small air space exceeding slightly the cubic content of the piston rod, so as to allow for the displacement of the water when the piston is driven to the other end of the cylinder.



HYDRAULIC BUFFER FOR CHECKING THE RECOIL OF HEAVY GUNS.

When the gun is fired, and with its carriage begins to recoil, the piston is driven back into the cylinder. The first effect of this is to compress the air in the cylinder very violently; then the water begins to run through the four holes in the piston; this motion soon attains a very great velocity; and in imparting this to the water, the force of the recoil is soon exhausted. It is spent in transferring the water with great rapidity through these orifices from one side of the piston to the other.

This rapidity depends on the ratio of the area of the piston to the area of the four holes in it. A very small diminution in the area of these orifices would cause the recoil to be checked very much sooner; a correspondingly slight increase would allow the piston to strike with violence against the end of the cylinder. It was found in an experiment with a twenty pounder gun, that when the holes were 0·562 of an inch in diameter, the recoil extended the whole length of the cylinder, 2 feet 9 inches, and struck violently the end of it; when a piston was used with holes 0·437 inches in diameter, the recoil was only 1 foot 11 inches, and ended quietly, the same charge being used. In another experiment with a twelve pounder gun in a boat carriage, the holes in the piston being five eighths of an inch in diameter, the recoil was 2 feet 2 inches; when the diameter of the holes was increased by one sixteenth of an inch, the recoil was 3 feet 2 inches. The reason of this is evident from a little consideration; first, every addition to the area of the holes diminishes the area of the piston, which acts on the water; secondly, the difference of the work done by the recoil is proportional to the difference of the *squares of the velocities* given to the water in passing through the orifices in the two cases.

The proper ratio of the area of the holes to the area of the piston is evidently that which will allow the recoil to expend its force in nearly, but not quite the whole length of the cylinder. When once this ratio is fixed, it is very remarkable that the amount of the charge, or the slope at which the platform is placed, whether up or down or horizontal, makes comparatively little difference in the length of the recoil. With a 12 tun (300 pounder) gun, a service charge of 30 lbs. of powder gave a recoil of 4 feet 5 inches; with a battering charge of 43 lbs. the recoil increased only to 5 feet 1 inch. If the charge be heavy, or if the slope favors the recoil, the carriage will not go much further back than if these conditions are reversed. But it will do so more rapidly. The space travelled over is not much greater with the violent recoil, but it is done in a shorter time. It is also worthy of notice that quick burning powder, such as the rifled large grain, does not give so long a recoil as the slow burning ones, such as the pebble and pellet powders, although it acts much more violently on the gun; the reason is that the recoil is more rapid. Few machines give so striking an illustration of how important an element is time in work to be done, and how much force is to be increased if anything is done more rapidly. The strength of one man is quite sufficient to push in or pull forward the piston of the hydraulic buffer, because he does it quietly, "takes his time to do it." The force of a 25 tun gun, recoiling from the discharge of 70 lbs. of powder, and a 600 lb. shot exhausted itself in doing the same, because it does it so quickly.

In fact, the ease with which the hydraulic buffer permits slow motion is one of its disadvantages, and prevents its application to sea service carriages, as it would not keep the carriages from moving as the ship rolled. A modification to obviate this difficulty has been proposed. It consists of a solid piston (without holes), and the back and front ends of the cylinder are connected by a pipe through which the water is driven by the recoil. The motion of the water can be stopped altogether by the stop cock till the gun is fired, and the area of the orifice through which the water is to pass can also be regulated by it.

The resistance of the water, and consequently the pressure on the cylinder from the recoil, is not uniform. It becomes greatest at the moment when the air receives its maximum compression, before the water attains its highest velocity in passing through the holes in the piston. At this point the force of the recoil is felt as a severe strain upon the cylinder and the platform which holds it. This destructive action of the recoil of heavy guns not only upon platforms, pivots, and racers, but also upon the foundations on which they rest, is one of the great difficulties with which modern military engineering has to grapple. To remedy this disadvantage by causing the recoil to meet with a gradually increasing resistance, so that its force may be felt as a continuous pressure, and not at any point as a shock or blow, the following very ingenious arrangement was proposed by Mr. H. Butter, Chief Constructor in the Royal Carriage Department. It consists in placing, along the length of the cylinder and through the holes in the piston, four tapering rods, the largest extremities of them being at the rear end of the cylinder, and being of such a size as there to fill completely the piston holes. These orifices and also the whole cylinder must be larger than when the rods are not employed. The effect in this case is that, as the area for the water to flow through the piston is continually diminishing as the holes get further along the rods, the force of the recoil has to impart a continually increasing velocity to the water, and is at no point felt as a shock or blow. The resistance, slight at first, gradually increases throughout the recoil, and so exhausts its force not at any one point, but throughout the whole of its course.

It has been suggested, and it is a consummation most devoutly to be wished, that the hydraulic buffer might be applied to railway trains so as to take away the destructive effects of a collision. A train of carriages separated by hydraulic buffers would, if suddenly stopped at a high speed, simply close up, the piston being driven in, and the force of the collision would exhaust itself in the motion given to the water in the cylinders. Some practical difficulties stand in the use of this application of the invention; principally, that the length of the piston rods would inconveniently increase the length of the train. But there are none which might not be overcome by a little ingenuity; and the great importance of the object to be gained makes the neglect of any promising means to attain it highly culpable. However, slowness in taking up new ideas (especially if they do not immediately add to dividends,) is not altogether a peculiarity of Government departments.

A very interesting pamphlet on this subject has been published by Colonel Clerk, in which Mr. Butter shows the work done in the hydraulic buffer, by comparing it with the momentum of a similar weight of water falling through such a hight as to give it the same velocity as that with which it passes through the holes in the piston. By this ingenious comparison he ascertained that a locomotive engine, weighing 50 tons, and moving at the rate of 30 miles an hour would be brought to rest in the space of six feet by two hydraulic buffers of 12 inches diameter. "There are," Colonel Clerk remarks, "two important problems to be worked out by the railway authorities;—(1) to have no railway collisions; (2) if they must sometimes occur, to render them as harmless as possible;" and it is with the second that he deals. The plan which has been so successful in meeting the violence of exploding gunpowder, should at least, have a trial in a case of far greater importance—security to life in railway collisions. To refuse this, on account of a few difficulties or inconveniences, seems a sin against Nature herself.

A Great Railroad Feat.

On Sunday morning, July 23d, between daylight and eleven o'clock, says the *National Car Builder*, the gage of the Ohio and Mississippi Railroad track, for a distance of 340 miles, was changed from six feet to four feet nine inches. This is, without exception, the greatest feat of the kind ever attempted. Every preparation was of course made in advance to facilitate the operation, and its accomplishment was so successful that the regular trains were expected to run by schedule time on the new gage by the following Tuesday. The force of laborers was distributed in gangs of eight men to each mile of road, and there was no cessation of the work from its commencement until it was completed. Twenty-eight locomotives and fifty passenger cars, including baggage, mail, express, parlor, and sleeping cars, have been reduced to the narrow gage, leaving seven hundred cars, of all classes, and fifty-four locomotives yet to be changed to the new gage. The difference between the old and new gage being fifteen inches, both lines of rails had to be moved instead of one only, in order to avoid throwing the weight of the trains too much upon one side of the track, bridges, etc. It is estimated that the entire cost of the change of track and rolling stock gage, including incidental expenses, will not be less than a million and a half of dollars.

The Flux Motor of Signor Tommasi.

The Emperor of Brazil has, according to our English exchanges, been much interested in a new motor invented by Signor Tommasi, which combines the use of the ebb and flow of tides with compressed air.

The power of the flux motor consists in the tension and rarefaction of the air produced, by the weight of the water of the sea raised by the tide, in a recipient having two divisions or compartments communicating with the sea. The compressed air acts upon an engine with the same degree of power steam does, provided it be at an equal tension; and the rarefied air, by permitting the exterior air to exercise a pressure proportionate to its rarefaction, enables it also, in its turn, to act with an equal degree of power. The flux motor is essentially composed: First, of a reservoir, by which the power is produced, which is to the flux motors what the boiler and its accessories are to steam engines. Second, of a motive apparatus, constructed, with some slight modifications on the principal of a stationary steam engine. Should a company undertake the expenses of instalment, and let out to manufacturers the motive force, at so much the cubic meter, in the same way as is done with gas, the manufacturers would be saved the enormous expense of boilers, which have to be renewed every ten years, the insurance premium, both against fire and explosions, the wages of the mechanics and stokers, and the cost of coal, which will necessarily become dearer in proportion as the mines become exhausted; and they will have to pay only for the motive force of which they have made effective use. The motive force of the flux motor may be applied to all kinds of industry, even to those where, on account of the inflammable nature of the substance to be worked, it is impossible to use steam. It is not affected by atmospheric variations, such as arise from decrease of water in rivers and waterfalls, and, moreover, it can never fail in its effects.

The idea of using the water force developed by the rise and fall of tide water, is quite old, and various forms of tidal machinery have been devised. It is common along the Atlantic coasts to place gates, across the mouths of inlets, which open on the rise of the tide, but close on the ebb. The hight of water thus obtained is then used to drive mill wheels in the usual manner.

Spindles for Loom-Shuttles.

Mr. ALBERT MORTON, of Salmon Falls village, N. H., has made an improvement in loom-shuttles, which consists in the application to the spindle of the shuttle of a lever in such a manner that, when the cop or tube is applied to the spindle, it causes the cam or lever to engage it in the interior near the base in a manner to insure the holding of the cop or tube till all the yarn is properly delivered, and prevent the escape of any except in the regular course. A long slot is made through the spindle between the heel and point, nearly its whole length. A long flat lever of steel or other suitable metal, is fitted in the slot and pivoted at a point located at about one third of the length of the lever from the end next the heel of the spindle, and so formed that near both ends it will rise above the upper surface of the spindle. At the end next the heel of the spindle the part so rising is preferably notched or serrated, but not necessarily, for it will answer well without. The spindle and lever are so arranged as to size, relatively to the cop or tube to be put on, that the end of the lever next to the point of the spindle will be forced down sufficiently to raise the other end up to press hard against the wall of the hole through the bobbin or cop, and hold it from slipping off when the yarn becomes slack, when nearly all drawn off, so that the friction is not sufficient to hold it. The lever is also so arranged with the spindle that the weight of the longer arm throws the shorter arm up when the yarn is unwound from the part of the spindle along the long arm, with sufficient power to retain the yarn. Two or more of these levers or cams may be used, if preferred. This improved cop retainer may be applied as well to the spindles of spoolers and other machines.

CUTTING GLASS.—Are any of the numerous inquirers who ask us for simple methods of cutting glass aware that this can be done with a strong pair of scissors, if the cutting be done under water? The edges of the glass can easily be trimmed afterwards by rubbing on a stone.

THE EAST LONDON MUSEUM OF SCIENCE AND ART.

One of the conditions upon which the English Government agreed to appropriate money for this institution, was a freehold site, and this, through the exertions of Sir Antonio Brady, the Rev. Septimus Hansard, and others (the Corporation of London and the Fishmongers' Company being among the subscribers), was obtained in Bethnal Green; the title deeds being presented to the Government by a deputation in February, 1859. On this occasion the deputation repeated the views of the promoters as to the nature of the museum which they wished to secure for the East End of London; their leading idea rightly being that it should be educational, in the strictest and widest sense of the term. All the subscriptions had been asked for and given with that understanding; and in making over the land to the Government, the subscribers pressed these views on the consideration of the Government. As regards the study of art, they felt this to be a matter deeply affecting the trade and commerce of the country, and urged it as one of imperial necessity. What they desired was that the museum should be made subservient to technical education generally, and prove not only a blessing to the million at the East End, but a model educational institution for all provincial cities and centers of manufactures to imitate. Earl de Grey and Ripon, as President of the Council, in accepting the deeds, made it understood, that the museum is not a local but a national institution; that it will form, as it were, an outwork of the South Kensington establishment, and will be dealt with upon the principles on which the Committee of Council act with respect to the South Kensington Museum.

THE EAST LONDON MUSEUM OF SCIENCE AND ART.

The site is a good one, some 4¼ acres in extent, in the midst of a dense population, and thereon the building is being erected. The main body of it, about 185 feet long, and 730 feet wide, is now approaching completion. It has been built under the direction of Lieut. Colonel Scott; Mr. James Wild, architect, mainly assisting in the design. The building is wholly of brick, molded where necessary, and the arrangement of the front marks the tripartite plan. Within there are galleries in the two side divisions and at the end, lighted from the top. The central portion will have a mosaic pavement, made by the convicts at Woking and elsewhere.

Our illustration shows the complete design as proposed, with library on one side, refreshment room and house on the other, with corridors leading to the road; but, it is stated, that the Treasury has just now determined not to erect these—at any rate, at present, the amount granted, £20,000, being nearly expended; absolutely necessary accommodation for attendants and so forth, is therefore to be provided in the basement of the main building.

ZANZIBAR gum is the most valuable for varnish making. Benguela gum stands next in value, and an inferior gum is known as kowrie.

WHAT IS STEEL?

The following is an abstract of a paper read at a meeting of the London Association of Foremen Engineers.

Steel is merely iron steeled or hardened, by being chemically impregnated with carbon, silicon, titanium, or any of those elements which possess more or less the hardening property; chemically impregnated, as the iron does not lose its special qualities, which it would do if the two elements were proportionately and chemically combined so as to form a new compound substance. There is, of course, a definite proportion of the chemically impregnating element, which confers the greatest amount of steeling or hardening property, entitling it so far to be called pre-eminently steel iron, or simply steel, variations from which proportion cause the metal to vary in respect of this property of hardness. According to this view we may regard ordinary cast iron as impregnated with too much, and wrought iron with too little, carbon, in both cases falling short of its strongest form, steel: or cast iron is a mixture of antagonistic steel and wrought iron, which is a very mild form of steel. Thus iron, which, in its pure, simple state, is comparatively soft, is chemically toned by carbon, silicon, or any one of the other elements used in forming steel. This toning may be underdone or overdone, or the different tonics may be all mixed up together, and to modify or neutralize each other's tonic influence. The same toning or hardening influence is to be found in the vegetable world, where we find silicon toning the strength of plants, as, for instance, in the straw of cereals, which is more or less stiff and hard, in proportion to the prevalence of silicious constituents in the soil on which it is grown; the length as well as the quality of the straw being influenced thereby.

The Bessemer process demonstrates distinctly the fact that there is no definite boundary between the three forms; that the percentage of carbon can be very gradually decreased from 1·25 per cent to a percentage scarcely appreciable in practical analysis, without altering the essential properties of the steel, except in lessening the degree of hardness. As the greater the percentage of carbon, up to a certain point, the harder is the metal; so the substitution of a harder impregnating element may be expected to produce a still stronger quality of steel, as, for example, with silicon; or the substitution of a softer impregnating element may be expected to produce a weaker quality, as with phosphorus; and this really seems to be the case. Carbon steel, however, is the kind in general use, and the only one whose qualities have been subjected to practical investigation. It is not only the proportionate amount of the carbon with which it may be impregnated that determines the hardness of the steel; for the same metal can be tempered, or have its hardness moderated.

Crystallization plays a necessary part in imparting the steeling or hardening property.

This is obvious in the practice of hardening steel by plunging it suddenly into cold water, by which it can be rendered so hard as to be capable of scratching glass. So also, on the other hand, an extreme degree of hardness may be reduced to almost any degree of softness by heating the steel. All the gradations are beautifully marked on the bright steel in deepening rainbow tints, guiding the manipulator by visible signs as to the relaxing temper of the metal.

The first tinge of yellow indicates that the steel has barely begun to soften, though it has materially increased in toughness. As the yellow deepens towards orange, the color indicates the degree of temper required for such articles as razors, penknives, and tools for turning, planing, chipping, and boring.

As the orange deepens, the color indicates a temper suitable for joiners' edge tools and table cutlery. When the changing color runs into blue, a temper is indicated that fits the metal for springs, and when it has completed the revolution and arrived at the color from which it started the metal has become nearly as soft as before it was hardened.

It is pretty evident that the relaxing temper of the metal is associated with a chemical action of the heat on the crystalline molecules of the iron. This action is, as yet, not very well understood. It depends not only on the nature of the crystallization of the iron, but probably also on the determination of the axial direction in which the crystals are formed. Only the finest iron is used in making the good steel, and the purer the iron the larger the crystals, but the quality of

the steel depends also greatly on the amount of carbon, and the chemical admixture of a foreign element reduces the size of the crystals.

The finer the steel the closer will be the grain of the fracture. This brings us to another phase of the question, what is steel? It may come before us in another form. How can steel be identified? How can its varying qualities be distinguished? This is the practical bearing of the question for those who have to realize it by inspection, and on correctness depend very important consequences. Supposing a piece of steel to be submitted for inspection, how can we test its character? If it be a steel rail it ought to contain one half per cent. of carbon. If it be a mild steel casting, it ought to contain about three quarters per cent., and if it be a piece of hard cutlery about a quarter to one-half per cent.

Of course the most correct estimate would be formed by analyzing the steel chemically, but that cannot be resorted to in the rapid turn-out of a factory, to any great extent. The nearest practical approximation to this is to dissolve a small piece of the steel in an acid, when the differing shades of brown will indicate the inherent proportions of carbon. Steel may also be tested as to its proportionate quantity of carbon by ascertaining its specific gravity, as the greater the proportion of carbon the less dense will it be found to be. The readiest method of testing the quality of steel is by examination of the fracture in a microscope. This requires considerable experience and a very powerful instrument. The unassisted eye may make a tolerable guess, but the result cannot be relied upon. Not so, however, where its power is multiplied by the powerful lens of a microscope. The crystals are found then to be octahedral, presenting the form ofa double pyramid, joined base to base. As the carbon decreases the pyramids become flatter, from the cubical form in cast iron down to the flattened form in wrought iron, which confers upon it greater capacity of being welded, and thus producing fiber. Between these extremes may be found a graduated series of pyramidal forms more or less elevated, according to the quality of the metal. If the steel shows under the microscope a regular and parallel crystallization (which may be pretty accurately ascertained if the fractured metal be held against the light), flashing back to the eye an uniform luster, like evenly serried needle points, the steel is of good quality. In proportion as it departs from this standard and shows groups of crystals whose diskal directions are not parallel, causing the needle like fragments of crystals to reflect a luster, patched here and there with shade, imparting to one portion a bright silvery tone, and to another a dark grey one, the metal is of inferior quality or make. Fineness and parallelism of grain can be produced by repeated melting, heating, or hammering, when cold or at a dull red heat. Cold hammering has the effect of producing an extremely fine grain.

A more correct estimate of what steel really is has had the effect of materially shortening the process of manufacture. The material itself has been made for upwards of 2,000 years, but only now, in the latter part of this wonderful century, has its manufacture been developed so as to show its capabilities.

Correspondence.

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

Compound Engines---Mr. Emery's Reply.

To the Editor of the Scientific American:

I have but just found leisure to pen a reply to the pointed, but courteous, editorial inquiries contained in the SCIENTIFIC AMERICAN of June 3, and relating to a paper I had previously read on the subject of compound engines.

The communication to which your article refers, namely, that of Mr. Harrison in the previous number of May 27, is a valuable one, as it acquaints your readers with facts difficult to obtain; and the example of Mr. Harrison in publishing his observations might be followed with advantage by many of your readers. Allow me, however, to take up the discussion of the facts where he leaves it, to do which, understandingly, and avoid repetition, I must request your readers to again examine the numbers of your paper of the dates above mentioned.

Mr. Harrison concludes, from calculations founded on the indicator diagrams, that if the steam supplied to the two cylinders of the "Magellan" had been used in the smaller of the two, and exhausted directly to the condenser, the addition of the large cylinder would have produced a gain of 19 per cent in power after deducting the estimated loss by additional friction.

This is doubtless true, but is foreign to the subject; for, let us suppose the steam to be used only in the larger cylinder, with the same initial pressure and measure of expansion as in the two cylinders. From the diagrams we find that the mean initial pressure was 47 pounds, and that the steam was expanded 1·29 times by wire drawing, and 2·2 times by the cut off on the small cylinder; also, that this expanded steam was again expanded 2·57 times by the difference in volume of the two cylinders, so the total expansion was $1{\cdot}29 \times 2{\cdot}2 \times 2{\cdot}57 = 7{\cdot}29$ times. [It will be observed, however, that the terminal pressure is lower than is due to the measure of expansion].

Now, if the steam used were let directly into the large cylinder and expanded 7·29 times, the mean total pressure by the usual rules would be 25·3 pounds, and deducting 4·3 pounds as ample for back and friction pressures, the remaining pressure, namely, 21 lbs. would be effective, and the power would be (using Mr. Harrison's figures) $\frac{21 \times 7224 \times 7{\cdot}50 \times 56}{33000} =$ 1930·8 horse power, or (1930·8—1659·8=) 271 horse power greater with the single cylinder than when both were used. This difference would, however, in practice, be much less as, with similar valve gear, the diagrams would be similarly rounded and modified in both cases, and the only difference would be that due to the loss of pressure required to transfer the steam from one cylinder to the other, or roughly about 75 horse power by the diagrams shown.

This review exemplifies the statement in my paper that "there is no gain in power by the addition of the small high pressure cylinder of the compound engine, for the effective pressure upon its piston is only the difference between that of the entering steam and that admitted to the second cylinder. There is, in fact, a little power lost in transferring the steam from one cylinder to the other." This loss in the case of the "Magellan" was about 75 horse power, or 4¼ per cent of the net power exerted.

The indicator has heretofore been considered a faithful guide, but in this case it shows a loss of 4¼ per cent against the compound engine when, in fact, such engine was actually saving fully one third the fuel as compared with the performances of other engines.

I do not think I can explain what I consider the true reasons of the economy of the compound engine in fewer words than in the paper you have referred to, and I trust you will consider the subject of sufficient importance to publish such paper in full in your journal.

In reply to the question asked in yours of June 3, I will say, first, that the glass and iron cylinders experimented with were both carefully felted to eliminate all condensation due to external refrigeration, and both cylinders being of the same size, and operated in precisely the same way, there could be no possible difference in the work done except that caused by the different quantities of steam in motion on account of the internal changes of temperature.

Again, it is true that the heat abstracted from the cylinder during the steam stroke is utilized as work in the expanding steam, but the heat thus withdrawn from the metal is returned thereto by the condensation of the entering steam at the beginning of the next stroke; and this condensed water, together with that resulting from the work done, is what is partially evaporated during the expansive portion of the stroke, but is more completely evaporated at the moment of the exhaust and throughout the return stroke, when all the heat abstracted from the metal to produce such evaporation is, of course, entirely wasted.

Again, a steam jacket produces economy because it evaporates the water from the interior surfaces as fast as it deposits, and therefore no water is left to be boiled by actual contact when the exhaust takes place. The losses by radiation at the moment of exhaust will still obtain, however, when the expansion is carried so far that more water is suspended in the steam inside the cylinder than the jacket can evaporate during the expansive stroke.

All discussions on the subject of the compound engine are really unnecessary, as the results obtained with the better examples of this class of engine show them to have remarkable superiority, and of this fact I trust ere long to convince you, Mr. Editor, with some compound engines of my design.

New York city. CHAS. E. EMERY.

Mr. Paine and his Detractors.

To the Editor of the Scientific American:

The great inventor, whose engine was so long in operation at Newark, N. J., whose achievements have satisfied so many of our greatest scientists, and for whom still greater successes are waiting in the future, has suffered the usual fate of the pioneer of invention, namely, detraction and calumny. Mr. Rowland more than hints at a surreptitious connection between the Paine motor and a steam engine in the same building. I think this insinuation is unworthy of a scientific investigator, and it is not to be wondered at that Mr. Paine has passed it by, no doubt thinking it beneath his notice.

Dr. Vander Weyde, another scoffer, has demonstrated that all Mr. Paine's results amount to the discovery of the perpetual motion; and although the Dr. intended to show a *reductio ad absurdam*, Mr. Paine's disciples will consider that Mr. Paine has as much right as anybody else to solve the tremendous problem of building a machine that shall create more power than is required to drive it. Now, while your readers are engrossed in the controversy, and are straining their attention to the coming demonstration, the newly discovered force of psychic power comes upon us. May not this agency have something to do with the motion of Mr. Paine's apparatus?

Even Mr. Paine's warmest admirers, knowing how logically and systematically all his experiments and reasonings are pursued, may hesitate to claim for him the honor of inventing the perpetual motion; indeed, with characteristic modesty, he himself deprecates the idea. But then the question arises, how is the mechanism operated? "How," as the boys say, "does the thing work?" I am driven to the conclusion that Mr. Paine, perhaps unconsciously, is the real discoverer of the psychic force, and that the results, the remarkability of which no one can deny, are to be credited to the mental power, courage, and indomitable will of the great inventor of Newark. I am strengthened in this belief by the visible fact that Mr. Paine's power augmentor (for that is the proper name for his invention) must be driven by some such agency. Mr. Home does more with a slight touch of his finger tips than strong men can do with the whole strength of the muscles. And a similar phenomenon must cause the motion of the Newark engine, whose running powers are otherwise inexplicable, and which must have considerably startled Mr. Paine when the machine first ran away at an unexpected pace.

The unfortunate persons called spiritualists are now about to receive the reward of their patience and long suffering. They have been taunted with the uselessness of their manifestations, and asked, if it be possible that spiritual power can find no better employment than turning hats and upsetting tables. These sneers will now cease, as a direct mechanical force, available for all purposes, has been demonstrated by Mr. Home, in the presence of witnesses of acknowledged honesty as well as intelligence, to exist in the mind of a highly gifted spiritualistic medium. If Mr. Paine's motor be the great want of the future, the apparatus that shall allow us to utilize, to direct, and to govern this omnipresent power, he will have obtained a reward for the years of patient investigation he has devoted to his invention. A far greater renown than that of discovering the self-moving machine will be his; and the sarcasms of all Vander Weydes, Rowlands, Smiths, and other extraneous and superfluous persons, will be silenced for ever.

B. D.

Jersey city.

Paine's Electro-Motor.

To the Editor of the Scientific American:

I have read with a great deal of interest the articles in your paper on Mr. Paine's electro-motor, and rather impatiently await the settlement of the whole question by the production, on the part of Mr, Paine, of a machine actually performing the work he claims for it, or its partial settlement by his failure to do so. I say *partial* settlement, for it seems to me that the question, whether such a machine as he claims to have knowledge of is or is not among the possibilities, would still press for solution, even should he totally fail to produce it. In the absence of a machine doing the work, the controversy must remain unsettled just so long as one palpable fact obstinately persists in existing. Allow me to explain by giving an example:

Place an electromagnet in the circuit of a current just sufficient to suspend, say, ten pounds in actual contact. Now break the circuit, and complete it again by placing in it another magnet precisely like the first, and either the current will suspend twenty pounds with no increase, or with only a very trifling increase. I know of no analogous fact outside of the phenomenon of magnetism. It is like getting one hundred horse power out of a fifty horse power engine by throwing an extra shovelful of coal in the furnace. It is like making a water wheel which operates a fifty horse power mill operate two such mills by throwing an extra bucketful of water into the mill dam. It is like a man who could resist the pull of an equally strong man being able to resist the pull of two such men by eating an oyster. The theory of the conservation of force is much talked of, and I have a profound respect for that theory, and for the processes of critical investigation which have been employed to produce it. But that theory is in no way interfered with in the electromagnetic phenomenon, unless it is insisted that the electric current produces the magnetic force, in which case the theory of the conservation of force would be overthrown. My mind can make nothing else out of it. If the electric current is the cause of the magnetic force, if it is changed into it by any imaginable process, then the facts in the case disprove the the theory. But it is a gratuitous assumption to insist upon any such transformation. Why may not the force or forces of magnetism always exist in the bar of soft iron, totally independent of the electric current, but in a state of equilibrium which that current disturbs? and while so disturbed, force be manifested which overcomes other forces, gravitation for instance, and which can be used for mechanical effect? The magnetic force in such bar of soft iron might be aptly likened to a train of loaded cars on an inclined road, with a stone resting on the track and blocking one of the wheels, and which stone had a tendency to always get under the wheel and stop the train unless forcibly prevented. Now the electric current knocks out that stone, and the train moves with a force entirely disproportioned to that which was required to move the "scotch," and it keeps moving as long as the stone is held out. If we now suppose an indefinitely long track, the breaking of the current merely stops the train. If we suppose a limited track, and the current be broken when the train had reached the lower end, then not only is the train stopped, but returned by great Nature to its starting point, ready to perform once again its work. It is like an infant pulling the "trigger" of a cannon, with Nature to replace the load. If the character of the magnetic force be ever understood, there may be known the breservoir from which its vitality is replenished. Whether there be such reservoir is now hidden in impenetrable darkness; at least, so it seems to me.

I am totally unacquainted with Mr. Paine; he may be a perfect charlatan, so far as I know; but is not the above mentioned fact of electromagnetism basis enough to sustain his wildest assertions? A very little reflection will show that this force makes possible a practically unlimited and costless mechanical power, so far as the destruction of values is concerned, in obtaining the initial current of electricity. Whether it is or is not a perpetual motion has nothing to do with it, so far as I can see, and the conservation of force is in no way disturbed by it, in our present condition of ignorance. To obtain millions of foot pounds from the consumption of grains of zinc may be Utopian, but in this case the foot pounds are obtained from the magnetic force. The grains of zinc pull the trigger, while Nature tends to the reloading.

I once heard Professor Smith, of the University of Virginia declare—and he performed an experiment before my eyes to prove it—that a small block of platinum, the densest of metals, had the power of stowing away within its own body, while under the influence of the electric current, a prodigious quantity of hydrogen gas, a quantity so great that no known mechanical force could succeed in compressing it into an equally small compass. This metal, he declared, seized the hydrogen and forcibly stowed it away within the

capacious recesses of its own body by a molecular energy of which we had very little conception. This may be somewhat akin to the magnetic action; but whether it is or not, I am waiting for some mechanical expert to convert this immense energy into available mechanical force. That the force is there, the plainest facts unmistakeably indicate, and some Watt, Fulton, or Morse will in time seize the thread which will lead out of the labyrinth into light; and when he appears, we will all help him go into glory. J. LANCASTER.

Baltimore, Md.

Steam Boiler Explosions.

To the Editor of the Scientific American:

Allow me to ask you: Is it not lamentable to see how little is known, by men who call themselves expert engineers, of men who claim to have had many years experience in the management of steam boilers? And to hear their various opinions, and see how ignorance holds its sway amongst the majority of those who are entrusted with the care of steam boilers?

I have no pet theory—electric, gaseous, or expansion—to discuss, nor do I expect to tell you anything about boilers or the generation of steam, that you do not already understand fully; but if you will allow me to address a few remarks through the medium of my favorite paper, the SCIENTIFIC AMERICAN, to the owners of boilers and the men who have charge of them, I may be able to set some of them to thinking, and from thinking to acting, and thereby prevent the loss of some lives as well as property.

All men who have anything to do with boilers should know that there is no piece of machinery or article of manufacture that affords facilities for cheating equal to a steam boiler; and if there be no design or intention to cheat on the part of the manufacturer of the iron, or of the boiler, if they neglect to exercise a most rigid supervision over their workmen, the boiler may go to the purchaser, having serious defects which will escape the scrutiny of persons who are well informed, even in regard to the construction of boilers. Then there are men who will agree to make boilers at prices which prevent them from using good materials, or having good work done on them. And there are many who call themselves good boiler makers, who do not know when a boiler is well made; and I am sorry to say there are many more who do not care whether the boiler is well made or not, so long as they get their pay. The malpractice of caulkers, riveters, etc., has frequently been commented upon in your columns, and I need not say anything on that subject. The stronger a boiler is, the better it will resist the sudden strains it will be subjected to every day it is used. But it will not do to depend on the strength of the boiler as a safeguard against explosion, for the strongest of boilers may be exploded, and the stronger they are the more violent the explosion will be, if one should occur. I presume most engineers who know anything, know that water is a very poor conductor of heat. I know of several kinds of boilers from which you may draw water cool enough to wash your hands in, several hours after the fire has been applied and the engine running. Does this not prove that water can only be heated by being brought in contact with the hot parts of the boiler, and that motion or circulation is necessary to enable the water to carry away the heat from the heating surfaces of the boiler?

Messrs. Engineers, have you not frequently observed a heavy thumping and jarring in your boilers when you first start the fires? Have you not seen large and heavy boilers made to vibrate at such times, so that everything about them shook as if shaken by an earthquake? If you have witnessed this phenomenon, did it make you think any, or did you try to inquire into the cause of it? And, gentlemen, do you not know that all of the violent explosions take place in boilers which have had all the outlets for steam closed for a greater or less length of time, and the water having been brought to a perfect state of rest, and then, not until the engine had been started, or the pump put in action or the safety valve began to play? Have you even thought of this? Have you ever asked if the boiler gave way from excess of pressure gradually produced? Why did it not go when the strain was at its maximum, which any one would naturally think was just prior to any steam being let off? Suppose, for instance, that you put a bar of iron in a testing machine, and work the pump until you have a strain of 70,000 lbs. to the square inch of section; then let the pump down until you have reduced the strain to 65,000 lbs., would you not be very much surprised to see the iron break at that stage of the experiment? Yet it seems that boilers do explode after being relieved of part of the steam they had safely resisted a few seconds before. And have we not abundance of proof that many boilers have exploded with a full supply of water in them? Is it not a positive fact that the more water there is in a boiler, when brought to a state of rest, the more liable it is to explode, and the greater the destruction will be if it does explode? For, are you not aware that when there is no steam escaping or being drawn from the boiler, that there is no ebullition within the boiler? That the water is perfectly calm and still, no matter how hot your fire is? And do you not know that water will not remain in contact with iron when the temperature is 400 degrees Fahr. or even less? If you have made yourselves familiar with these facts, has the remedy not suggested itself? A great deal has been said about the engineer—I presume I must call him by that name—of the *Westfield* carrying 27 lbs. instead of 25 lbs. steam, and a great many people are satisfied that was the cause of the explosion; but it was not the cause. I will take charge of a boiler in the precise condition that boiler was in one hour before it exploded, and run it five days or five weeks, with a pressure of 40 lbs. per square inch. No, the boiler on the *Westfield* was not exploded on account of there being a scarcity of water, nor by an over pressure of steam gradually increased from the pressure indicated by the gage when the boat came into the dock; but it gave way under an instantaneous pressure, the extent of which no man can calculate, but we may guess at it, after seeing the fragments of iron and staunch timbers which were torn to pieces, and by carefully considering the immense weight of matter that was suddenly put in violent motion. There is a class of men—and their name is legion—who still persist in the belief that boiler explosions are caused by some mysterious agency. If any such wish to be enlightened as to what that mysterious power is, let them furnish me with two boilers similar to that on the *Westfield*. And with fire and water only I will explode one and burst the other. The one I will cause to explode shall have three cocks of solid water, and shall explode with as much violence as the one on the *Westfield* did; while the other shall have less water and shall merely burst without moving one foot from where it is placed. And if they are not satisfied with one experiment, I will repeat it as many times as they wish. Let all persons owning or having the care of boilers see that the water does not stand still more than one minute or two at the most, while there is any fire about them, and I will guarantee they will have no violent explosions. Knowing the safety valve to be in good order and the gage to be true, does not insure safety. But keep the water in motion, either by lifting the safety valve, opening the blow cock, or working the pump.

Unceasing vigilance is the price of safety, when dealing with steam boilers, as well as with gunpowder or nitroglycerin. D. A. MORRIS.

18, Platt street, New York.

The Explosion of the Westfield.—What Caused It.—Dangerous Management of Boilers.—Possible Prevention of Violent Explosions.

To the Editor of the Scientific American:

This communication, upon the cause of the *Westfield* explosion, and upon the means to prevent such calamities, aims to exclude all matter not based on known facts, and to point to such precautionary measures only as are supported by well known physical laws and proved by experience.

To present the matter clearly, the following well known facts as to boilers must be kept in mind:

1. It is practically impossible to provide for uneven expansion and contraction in boilers.

2. A boiler cannot be made so strong as to withstand unequal expansion and contraction without deterioration. And its giving way under such circumstances is but a question of time.

3. Red hot iron plates do not make steam faster than nor so fast as plates under usual heat, because intervening steam prevents sufficient contact with the water, as proven by experiments.

4. Red hot "kitchen water backs," sectional boilers, etc., forming receptacles of comparatively small extent, will not burst by the sudden application of water, as proved by experiments.

5. Red-hot plates in a boiler act disastrously by causing unequal expansion and great strain, and by the weakness of the parts so heated.

6. Water contains air, which upon ebullition escapes, and leaves the water inclined to "solidify;" that is, to acquire great adhesion of its particles to each other, in which state it resists the formation of steam.

7. Water so deprived of air requires constant circulation to prevent its acquiring heat far beyond its pressure, which excess of heat may amount to over 100° Fahr.

8. When the engine is standing still, the fires are burning, and no feed water is being fed in, or circulation caused in some way, the water in the boiler is in the best possible condition for storing up heat, as named in No. 7, which upon commotion or too great an overcharge of heat, will flash into steam with explosive force.

9. The overheating of plates is not only caused by low water, but it also takes place, in a less degree, in a boiler well filled, when there is no circulation in the same; because water and steam carry heat by convection, very little by conduction; hence without circulation they but imperfectly relieve the plates of heat.

What were the facts in the case under consideration?

Captain Vanderbilt states: "When one of our boats starts from the dock at Staten Island, the custom is to feed from four cocks until Quarantine is reached. There is then more than enough water in the boiler to carry her to New York, and the supply is shut off. It is the engine that feeds the boiler, and consequently no feeding can be done while she is lying still."

Robert Crofton, the fireman, told Vanderbilt that he tried the boiler and found it three cocks full. He then turned to open the furnace door, when he heard a hissing noise. The boiler gave way.

The boiler was therefore without a fresh supply of water (and air) for at least an hour. And the engines stood still, the fires burning with the door shut for over half an hour, or perhaps much longer. In half an hour, the fires, burning at half the usual intensity, would under normal circumstances produce over 67,000 cubic feet of steam at twenty-seven pounds.

As the explosion took place before the boat started, and the adhesion of the water was therefore not overcome by the commotion due to the drawing of steam from the boiler, the mass of the water, or much of it, must have been overheated to its limit or nearly so, flashing into steam by an addition of heat beyond its capacity to hold, and by the action of the safety valve.

What would be the result?

The boiler occupies about 1,900 cubic feet of space, the cylinder having a capacity of 140 cubic feet, the steam room is estimated at about 700 cubic feet, the water space at about 700 cubic feet, and the furnace and flue space at about 500 cubic feet.

Seven hundred cubic feet or 44,000 pounds of water, if surcharged with only an average of 50° Fahr. of heat beyond that due to its pressure, will, upon losing its cohesion, flash over one twentieth of its contents into steam, amounting to 22,000 cubic feet of steam at twenty-seven pounds pressure, the steam space being only 700 cubic feet, and already filled.

The safety valve was blowing off violently, as explicitly testified to by H. R. Hale, who left the boat on account of the noise, to be able to speak to a friend. That valve had twenty-eight square inches area, capable of blowing off 1,120 pounds of steam per minute, or 190 cubic feet per second at twenty seven pounds pressure (above the atmosphere), more than three times as much as the boiler is capable to produce within that time without accumulated heat. But this valve, or any valve, is totally incapable of passing off 22,000 cubic feet of steam, produced by released accumulated heat in a moment of time.

The question is, why does this not happen frequently, as this practice is unfortunately not solitary? The answer is, that if, under the figures above assumed, the boiler could have withstood seventy-five pounds of pressure which consumes 50° more heat than twenty-seven pounds, no harm would have arisen.

It is, however, more than likely that even with only a few degrees of accumulated heat, the sudden explosion of water into steam, assisted by the momentum of the masses suddenly set in motion, may cause a momentary violent strain upon the boiler, which a second after is scarcely perceptible upon the pressure gage. The latter may not even indicate but imperfectly the sudden strain in the boiler, by reason of its suddenness, and the small and often tortuous communication to the gage.

Circulation should always be provided for, particularly while the engine is standing still, either by the feed pump (independent pump) or otherwise. And if the pump is to be stopped, let it rather be done while the boat is under way.

If circulation be preserved, the water will not accumulate heat, but will evaporate as fast as it receives heat. Without circulation comparatively little steam is made, and the safety valve does not blow off until after the water is fatally overcharged with heat—too late to notify the fireman to open the furnace doors.

Without proper circulation the steam may be much hotter than the water, or the water hotter than the steam, while the boiler plates become unduly heated and weakened, with the final fatal result sure to follow continued unequal expansion, if the injury caused by it is not discovered in time.

While the most careful boiler inspections are thus of the utmost importance, and indispensable, they do not give entire security against explosion from the cause named; and the less so, the greater the mass of water in the boiler. And safety valves in such case lose their efficacy.

How often our lives thus hang "but by a thread," while taking passage on our boats or in passing over sidewalks and by houses hiding away thousands of boilers from view, we fortunately do not know. ROBERT CREUZBAUR.

Williamsburgh, N. Y.

Psychic Force.

To the Editor of the Scientific American:

The names of Professors Crookes and Higgins are guarantees for the genuineness of the experiments, described and illustrated in your issue of August 12th; and the investigation is thus narrowed to the question of the origin and nature of the force, the existence of which cannot longer be doubted. And there seems to be great probability that evidences of the existence of this force are of daily occurrence, and are so familiar to most men that we wonder that enquiry as to their cause has not been pursued before. But most new discoveries of this kind are found to be exemplified under our eyes, no man regarding them.

We are all familiar with the fact that, in times of necessity, danger, and otherwise when under great excitement, a man can execute feats of strength which are impossible to him in moments of mental calmness and repose. Instances of the exertion of power, far exceeding the capability of the muscles, will occur to the memories of most of your readers. What are these but exhibitions of Psychic Force, a dynamic power proceeding from the will of man, purely mental in its origin, unconnected with and unaccountable for by any physical power of the doer? D. B.

New York city.

Mr. Paine to Mr. Smith.

To the Editor of the Scientific American:

I have only time to say, in your present issue, that Mr. Smith's last article is a tissue of falsehood and misrepresentation, as will be abundantly proven in your next.

H. M. PAINE.

Newark, N. J.

THE Life Companies doing business in New York in 1870 had capital stock amounting to $10,768,483; received income of $106,586,226; paid on lapses and surrenders, $9,625,687, and on losses, $19,675,880; expenses of management, including taxes, $18,307,724. During the year, 235,706 policies, covering $567,929,471, were issued. At the close of the year, 775,381 policies were in force, covering $2,081,270,843. This shows a decrease in the amount of business of 14 per cent. Only three companies seem to have escaped this decrease.

W. H. WINDSOR'S PRINTER'S CHASE.

We not long since illustrated an improved printer's chase devised by a French inventor, in which clamping bars were made to advance and compress the types by the direct action of screws. We herewith give engravings of a still more simple method invented by W. H. Windsor, of Little Rock, Ark., and patented through the Scientific American Patent Agency, May 30, 1871.

The invention combines with simplicity great power of compression, ease in working, strength, and durability of parts, and merits the attention of practical printers.

The construction and operation of this chase will be readily understood. The outer iron frame has a re-entrant angle at A, as shown. This enables the chase to be made enough wider on two sides, to make room for the locking screws, B, which extend across the chase on two sides, as shown, and are provided with strong durable threads, and well finished hexagonal heads, to which the locking key or wrench is applied.

Fig. 1

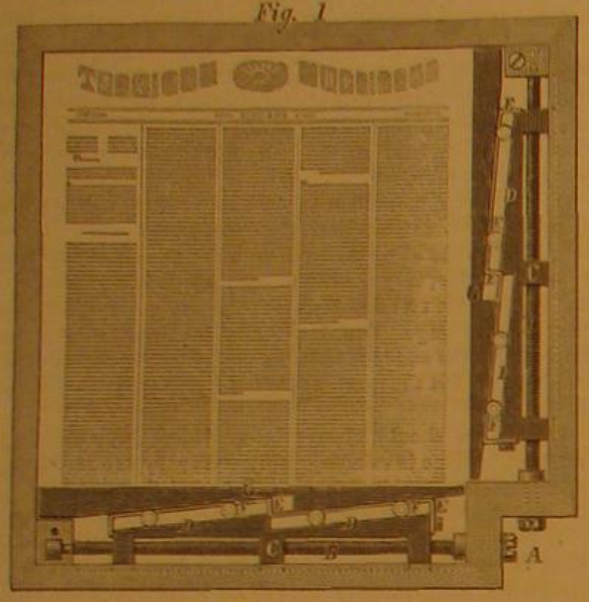
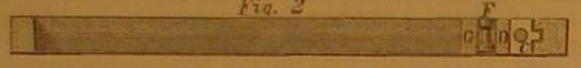


Fig. 2



These screws are held stationary by suitable collars, and run in female screws, C, formed on the side sticks, D, each of the latter having one or more inclined planes formed on its inner side as shown.

A bent guide bar, E, is also attached to each of the side sticks, D, which bar serves to hold in place friction rollers, F; these rollers having grooves turned in the middle, into which the guide bar fits. The side sticks, G, having inclines reversed to those on the side sticks, D, complete the apparatus.

It is obvious that turning the screws so as to force the higher part of the inclines on D, toward the higher part of the inclines on G must cause a powerful movement of the latter towards the type to be compressed, the principles of the screw and inclined plane being combined, and the friction being greatly reduced by the friction rollers, F.

The lugs containing female screws on the side sticks, D, have tenons which run in grooves in the side of the chase, as shown in section, Fig. 2, and in dotted outline, Fig. 1.

For further information address W. H. Windsor, Little Rock, Arkansas.

SHAW'S COMPOUND PROPELLER PUMP.

Up to the present, the Cornish pumping engine has been considered as far the most efficient machine for elevating water from mines, or for raising large volumes of water for purposes of irrigation or the supply of large cities. But while its efficiency is acknowledged, its great cost has been a standing objection to it, especially in this country where large enterprises are often begun with comparatively limited capital; and where, consequently, first cost is often a matter of greater importance than current expenses. On this account a field has been opened for the employment and sale of many machines less economical in running than the Cornish engine, but costing much less at the outset.

It has been the constant struggle of the inventors of the cheaper class of pumps to approximate as far as possible in economy to the Cornish engine, and assuredly a very fair measure of success has been attained. We this week illustrate a powerful pump placed in exhibition at the Novelty Iron Works, 745 East Twelfth street, New York, by General H. S. Lansing, and which is certainly worthy of most careful examination by those interested in such matters.

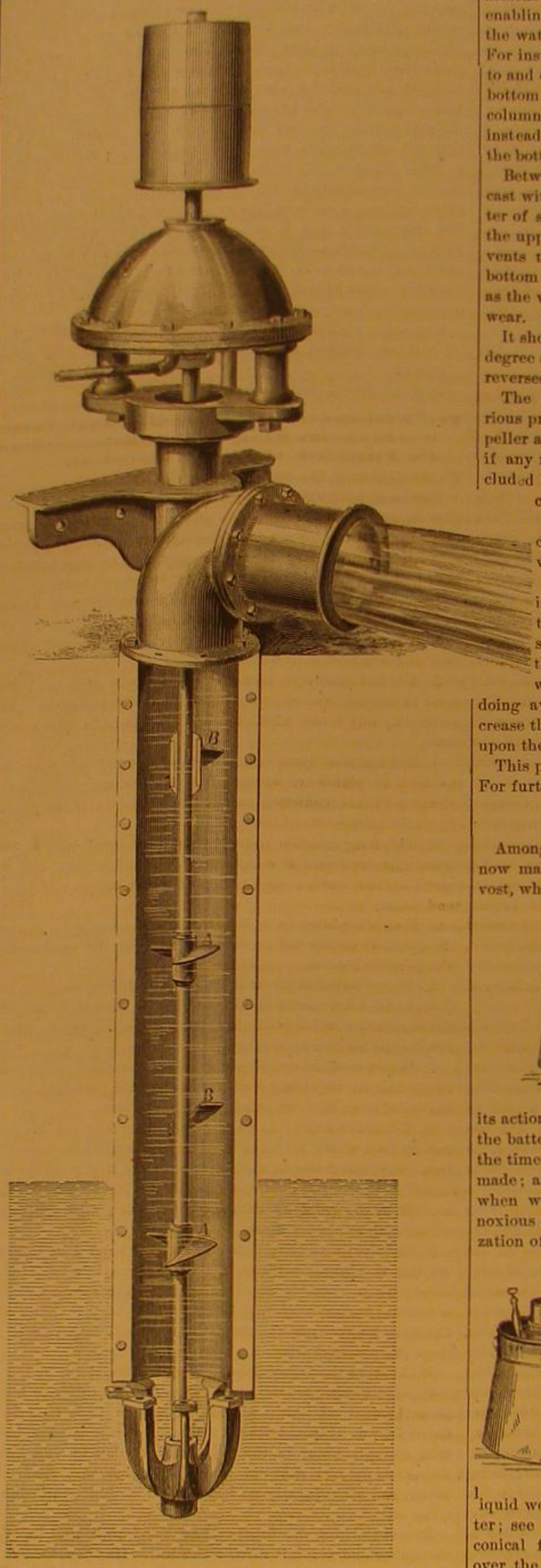
Various sizes are shown working, the largest being twenty inches in diameter, asserted to be capable of lifting 14,000 gallons of water to any hight per minute, with an expenditure of 1 horse-power to every three inches of elevation. We made no test to corroborate this statement, but the pump was evidently delivering a very large quantity of water; and we were offered opportunities to test its capacity, but had not time to avail ourselves of the offer.

Another pump, seven inches in diameter, was raising a large body of water 43 feet. Its discharge was stated to be 1,000 gallons per minute. This pump requires one horse-power to every 42 inches of lift.

A third pump, 1¼ in internal diameter and ten inches long, to which a short hose was attached, threw a powerful stream up through a skylight window to a considerable hight above the building. This pump a boy could have carried away in his hand.

The power consumed by friction of working parts is very slight, as the main shaft with its propellers and pulley are suspended on a water bearing of peculiar construction, of which we shall say more in describing details. The amount allowed in the above statement is about one eighth, which we consider large.

The following advantages appear to belong to this pump in addition to its great delivering capacity.



Its construction is extremely simple. It has no valves, and consists only of the column pipe, shaft and propeller. It can be used in any position, vertical, horizontal or oblique, either as a force pump or lifting pump. The small pump above alluded to as working with hose attached, was placed in a horizontal position. The first cost of this pump is very much less than any other of the same power with which we are acquainted, and we judge its utilization of power in work is fully up to that of the better class of pumps. It carries through sand, sticks and rubbish without interruption of its working, there being no valves to clog. In this particular it appears to be admirably adapted to use on ships; no amount of wet grain could choke it. The water bearing, above alluded to, prevents the necessity of oiling. Lastly, it will raise water to any hight.

Our engraving illustrates the seven inch pump, which is in every essential particular like the other sizes. The vertical shafts are shown suspended on the water bearing. This consists of two disks of peculiar construction, between which water is forced by a donkey pump, the water escaping at the outer edge, and passing between the disks in a thin film which effectually separates the solid surfaces. Those familiar with the application of this principle to turbines will need no assurance as to its effectiveness in the reduction of friction in this class of machines. The construction of this water bearing admits of its being placed above or below the weight it sustains. This is an important advantage so far as this pump is concerned, for it allows the pump to be driven by a pulley attached to either the lower or upper end of the shaft, thus enabling the motive power to be placed on the same level as the water to be lifted, which is in many cases very desirable. For instance, this pump could be made to pump water up to and over into the top of a stand pipe, instead of into the bottom as now practiced; thus allowing the full weight of column in the stand pipe to transmit its pressure to the mains instead of acting against the current of inflowing water at the bottom. The vertical shaft carries screw propellers, A.

Between each two of the propellers is placed a fixed rest cast with and upon the column pipe, as shown. At the center of some of the fixed rests are found bearings as shown at the upper part of the engraving, which in long pumps prevents the lateral springing of the shaft. The step at the bottom of the shaft also acts more as a guide than a bearing, as the water bearing above relieves it from pressure and wear. The shaft is driven by belt and pulley, as shown.

It should be observed that the fixed rests have the same degree of pitch as the propeller screws, but that the pitch is reversed in direction.

The precise way in which this arrangement acts is a curious problem. Pressure gages show that between each propeller and the next in succession, the lateral pressure is little if any more than that due to the length of the column included between the two screws, and that this is pretty nearly constant at any part of the column.

We are informed that this pump has proved its efficiency in pumping mines, raising vessels, etc., and that wherever used it has given the greatest satisfaction.

This pump could be made the means of procuring, for Central Park, fountains second to none in the world, at a current cost far less than that of many similar fountains in Europe. We are informed that the proprietors have offered to supply Philadelphia with water at half the cost of the present supply, doing away entirely with the present works; and also to increase the supply to double the present amount. This we state upon the authority of several prominent dailies of that city,

This pump was patented by Thomas Shaw, Feb. 15, 1870 For further particulars, address Gen. H. S. Lansing, as above

EMILE PREVOST'S NEW BATTERY.

Among the numerous improvements in electric apparatus now making their appearance, is the battery of Emile Prevost, which is claimed to act as soon as charged, and to cease

its action when the electric current is cut off, without taking the battery to pieces. The battery incurs no expense from the time the circuit is broken until the connection is again made; and, it is asserted, is always ready for immediate use when wanted. A further advantage is the absence of all noxious or offensive fumes, and the preservation from oxidization of the small connecting pieces between the carbon and the zinc.

The form of the battery is similar to the famous Bunsen cell, with the exception that, in the Prevost battery, a hollow cylinder of carbon replaces the porous cup of Bunsen's.

The three elements of the Prevost battery are: first, an earthen or glass jar, A, into which water, slightly impregnated with sulphuric acid, is poured until the liquid weighs three degrees according to Beaumé's acidometer; see accompanying engraving. Second, a zinc, B, whose conical form presents, it is claimed, a notable advantage over the old fashioned straight zincs; and third, a hollow cylindrical carbon in which Barjon's new patented acid is employed as a substitute for nitric acid; an india rubber lining being set round the carbon at the top and on the outside, to isolate it from the zinc.

The patent for the battery bears date July 7, 1871. The battery fluid alluded to was patented by V. Barjon, July 11, 1871. This is furnished, in carboys, to purchasers. It is very highly spoken of by those who have used it.

The Prevost battery has been assigned to Mr. Barjon, who now undertakes to fix large surface batteries for telegraph companies, for the economical production of electric light, for gilding and silver ware manufacturing.

Further information may be obtained by addressing him at No. 36 Amity street, N. Y.

M. SOMMELLIER, contractor for the construction of the Mont Cenis tunnel, is dead.

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BOILER EXPLOSIONS.

While the Coroner's inquest on the recent disastrous explosion on the steamer *Westfield* is in progress, and the various experts and inexperts are airing their theories of boiler explosions, the public stands in dismay, breathlessly asking whether, with so many causes for the violent disruption of boilers, there is any immunity from imminent danger in travel by steam or in proximity to steam motors.

Surely, if boilers explode through the formation of explosive gases, through external atmospheric influences, through unequal expansion by heat, through bad caulking and riveting, through deficiency in the quality of iron, through not having saddles enough, through being eaten away with rust, through safety valves sticking, though pressure gages getting out of order, through carelessness on the part of attendants, (which last includes a category of causes in itself), etc., etc., it would seem that steam is hardly less dangerous than dynamite or nitro-glycerin, and we had better go back to first principles, restore the old "diligence" and "stagecoach," and give steam boilers a wide berth.

Now some of the above alleged causes are no causes at all, and others are causes only in connection with other things.

The gas theory is itself gas, the atmospheric influence theory will influence no mind except such an one as ought never to meddle with a boiler. Unequal expansion may weaken or even rupture, but alone will never violently explode a boiler; a boiler weakened by caulking, or imperfectly riveted or stayed should show these defects in time to prevent trouble; deficiency in the quality of the iron is a matter inspectors ought to be able to determine, and with a proper system of testing and marking plates could always determine. They also could tell or ought to be able to tell if boilers are set so as to break their backs. Corrosion and channelling are easily discovered faults. Safety valves and gages are certainly within range of observation. Care on the part of attendants can be enforced by low water alarms and other appliances, but more than all by paying a fair price for intelligence, skill, and conscience.

If any of the essentials of safety named are absent, a boiler may either burst, or explode, but whenever it does so, the final cause will be that it has within it more pressure than it can withstand in its condition at the time. If the pressure is applied gradually, it will rupture and leak steam or water or both; if applied very suddenly, it will rend the boiler to pieces which will be scattered as deadly projectiles, followed by water and steam to complete the work of destruction.

We desire to call attention to the letters upon boiler explosions published this week on another page. These letters state clearly some facts deserving the most careful attention at this time. It will be seen that explosions taking place under circumstances such as those of the Westfield disaster are attributed to pressure *suddenly* generated, and the method by which this sudden pressure is generated is well described. Miller in his "Chemical Physics" (Vol. 1, of his excellent treatise "Elements of Chemistry"), states that water with the air expelled from it has been heated to 360° Fahr. in an open glass vessel without boiling, and upon reaching that temperature it suddenly expanded into steam, shivering the vessel to atoms and scattering them like powder. This is an experiment that may be easily repeated; that is, if not with the same violent result, with something sufficiently approximating to it to convince any one that it is dangerous to force heat into still water when the air has been boiled out of it.

Is the experiment ever repeated in steam boilers, and was the Westfield explosion the terrible *finale* of such an experiment on a large scale? We believe it was.

If boilers do thus explode, what is the remedy? Simply to maintain circulation therein, mechanically if necessary, so that the steam will generate constantly instead of by explosive bursts.

While thus supporting the belief of our correspondents in regard to the sudden generation of steam, we would not be understood to say that we think boilers may be overheated without danger, or that neglect of any sort is to be palliated on the part of any one who deals with boilers, from the manufacturer who purchases the iron, through the whole list of workmen employed in building it, down to the man who fires it. But we surely cannot blame attendants for allowing boilers to explode from unrecognized causes, not understood by them nor required by inspectors to be understood by them; and the cause we have named we believe not to be generally understood, though it is in our opinion the most common way in which boilers are blown to pieces.

One word now as to low water alarms. Every steamboat or ship should be furnished with a low water whistle of a kind the sound of which would instantly inform every passenger on board that the water had approached to within a prescribed limit of the line of danger. The screech of that whistle should be the signal of discharge for the engineer who permits it. This whistle should be daily inspected by some superior officer, and a certificate that it is in order should be hung in a conspicuous place where passengers may read it. A pressure whistle should also sound an alarm when the pressure exceeds the limit allowed, and both whistles should be locked up so that the engineer may not tamper with them.

We believe disastrous explosions of boilers need not occur, and that when they do occur they are generally the final result of ignorance, carelessness, or the compelled use of defective boilers through the avarice of owners. As a rule there is blame somewhere, and those who are to blame ought to be punished.

THE DISPOSAL OF SEWAGE.

This vexed question still retains its interest, notwithstanding that it has been discussed at greater length than almost any other engineering problem of the day. We say "engineering problem;" in reality it is a chemical problem also, for we have no doubt that any scheme not based upon chemistry, as well as mechanics, will prove a failure in practice.

Herein is found the probable explanation of the many failures which have attended the attempts to substitute better methods of sewage disposal than its discharge into rivers.

The system of sewage irrigation, that is, the conveyance of sewage in the liquid form to the surface of lands it is desired to enrich, is, in our opinion, so objectionable as not to be tolerated in any civilized community. Such a distribution of undeodorized fæcal matter taints the atmosphere with the most loathsome of odors.

We are not aware that any experiments in sewage irrigation have been attempted in this country, but in England there have been many. A pamphlet, written by James Alexander Manning, and published in London last year, states that the odors arising from two or three hundred acres of the Craigentinny Meadows, near Edinburgh, thus irrigated, were at times almost insupportable for miles around, creating nausea and sickness. The effect upon even the cattle fed upon these meadows was disastrous. Mr. Manning says that a dairyman of Edinburgh lost 92 cows in three years from feeding them upon the grass of sewage-irrigated meadows, and another lost his whole stock in two years from the same cause. He remarks further: "These losses, which would have brought ordinary London dairymen to a state of bankruptcy, did not seem greatly to affect their spirits, for in answer to my expression of sympathy, they coolly observed, 'but sir, they gave an uncommon sight of milk before they died.' I subsequently ascertained that these poor animals were milked while lying groaning in their byres in the last stage of pleuro-pneumonia—a disease which these very men attributed entirely to the unwholesome and poisonous quality of their food. When I remonstrated with them upon their inhumanity, they simply replied, 'we must do as our neighbors.'

"Several letters had, about that period, appeared in the *Scotsman*, the most influential journal of Edinburgh, under the signature of 'A Looker On,' in which the writer alludes to the unwholesome quality of the Edinburgh milk, and instances several cases in which families, arriving from the North had, after a few weeks, been compelled to send their children back again, all of them having been affected with sickness and loss of appetite, from which they recovered as soon as they were removed from the capital. I brought these facts to the notice of the late Dr. Frederick Penny, Professor of Chemistry, at the Andersonian University, Glasgow, one of the most eminent and distinguished chemists of the period, and he declared that, in his opinion, the rank grass of sewage irrigated land would have a tendency to produce pleuro-pneumonia in cattle, and that the fact of the disease being much more prevalent in all places where the cows were fed upon grass so raised, was a strong confirmation of that theory. At the same time he stated, without the slightest hesitation, his decided objection to the use of the milk from cows, laboring under that disease, which could not be otherwise than injurious to health in general, and while totally unfit for human food, was more particularly dangerous as food for infants."

These facts are sufficient to condemn the practice of sewage irrigation, and it is evident that any system which contemplates the use of sewage as a fertilizer for land must provide for a chemical change in its character. Raw sewage on land is even worse than contaminated water fronts.

It is not our purpose to commend any existing process or plan for the disposal of sewage. Our preference has already been given to the earth system, and, in all the facts elicited throughout the protracted discussion of this most important question, we have yet seen no reason to change it. It has seemed to us that a modification of this system by which the sewage of large towns could be treated in bulk, is possible. The A B C process is, in fact, a modification of it. In this process, alum, blood, and dry pulverized clay are the materials employed to precipitate and absorb the solid matters and salts contained in sewage waters; and if statements made in regard to it are reliable, the results attained are very encouraging.

The writer of the pamphlet alluded to has devised a process by which the excretæ are completely deodorized and disinfected in cess pits or other receptacles devoted to that service; removed in hermetically closed carts, discharged into hermetically closed evaporating chambers and evaporated to dryness; the deleterious gases, the soot and gaseous products of the coal employed in the manufacture, together with the vapors from the liquid portion of the fæcal matter, being all drawn off from the evaporating chamber by means of a powerful exhaust and discharge fan, made to rotate with great velocity by means of a powerful steam engine.

The operations of collecting, treating, and discharging are to be done in hermetically sealed vessels and compartments the emptying and filling of which are accomplished by pneumatic pressure. As thus described, the process is not a mechanical one purely, but it embraces the use of chemicals by which the sewage is not only disinfected and deodorized but also prepared for use as manure, in a perfectly unobjectionable form.

We regret that Mr. Manning does not in his pamphlet give more light upon the chemistry of his process, as we think he has comprehended the true nature of the problem which many have vainly tried to solve. We shall await with interest any further particulars, and shall, if possible, examine such statements of results as may appear, should his process be tried on a scale sufficiently extended to test its merits.

HOW TO BECOME BANKRUPT BY MANUFACTURING.

Not a few, adopting the maxims we are about to promulgate as rules for conducting a manufacturing business, have succeeded in being conspicuously unsuccessful. If any others wish to follow in their illustrious footsteps, let them adhere strictly to the advice we shall give, and we will guarantee the desired result.

Let them branch off into many kinds of manufacturing, or, if manufacturing any particular class of goods, confine themselves as closely as possible to making as many different varieties of wares as the class will permit of. The first is a better and more rapid road to ruin, but the latter will do, provided that:

They so keep their books that they cannot tell how much or little they are making or losing upon each variety of articles they produce, or whether there is either profit or loss on their entire business except when the annual balance sheet is made up. We have known persons who were so foolish as to employ skilled book keepers to keep them informed as to the state of their liabilities and assets. It is rare that such men fail so conspicuously as to acquire public fame. Their example should be avoided by those ambitious to become noted bankrupts.

Let those who wish to fail, also hire as much by the day or week as possible, and eschew the system of "piece work." It is astonishing how much this will grease the wheels of financial disaster, especially if,

They leave everything in charge of a salaried superintendent, not above having his favorites among the employés, who become favorites by seeing that he does not want for a gold watch at Christmas, or cigars to regale himself with during the rest of the year.

Finally, having got things in this way well in train, be sure and take no care of remnants. Let them take care of themselves. To become a bankrupt, one must not respect economy. Economy has stood between many a man and the debtor's prison or the alms house. Therefore, have nothing to do with it. Let scraps rot, and material run to waste. Spend as much time as you can with fast horses, in shooting, fishing, etc., leaving business to the superintendent. When a pinch comes, borrow money, having full faith that it will be easy to pay it when due. So shall you find smooth sailing and fair breezes to waft you swiftly to a port where you will find no lack of congenial society.

COMBUSTIBILITY OF DIAMONDS—VARIOUS EFFECTS PRODUCED BY HIGH TEMPERATURES.

A great many questions are asked, among men of science, as to the degree of combustibility of diamonds. When a diamond is exposed to a very high temperature, does it become black and porous? or does it disappear by volatilization? A few experiments on this subject have been made lately in France.

A celebrated jeweler of Marseilles had been ordered to re-enamel two rings surrounding two fine diamonds of great value. Generally, in such cases, the stones are taken out of the mounting, but he resolved to enamel the gold without removing the stones, and, not having charcoal at hand, he heated the enameling muffle with cannel coal.

The enameling, in coming from the furnace, looked very

well, but to his great stupefaction the two diamonds had become of a jet black.

Everything was tried to restore them to their former brilliancy and transparency, but without effect; the two diamonds had the appearance of very dark plumbago. Then the stones were taken from their mountings, and sent to London to a lapidary, and the simple contact of the lapidary's wheel was sufficient to render them their luster and former beauty; and the weight of the stones was not even changed.

A chemist then reproduced the experiment by replacing the jeweler's muffle by a platinum tube; and Mr. Laurin, a diamond merchant at Marseilles, put diamonds at his disposal for experimenting. In the platinum tube, the chemist passed common street gas, and brought the temperature to a white heat. The diamonds, having been carefully weighed before experiment, came out from the tube entirely blackened. On the inner surface of the platinum, a deposit of carbon had taken place which was easily removed. The diamond, on the contrary, had a lamellar appearance, and were crystaline in color, and similar in every point to plumbago or retort coke; and the black deposit on them were very adhesive.

The chemist, Mr. Morren, then heated the stones to a red heat, and the black coating disappeared entirely; the diamonds resuming their former weight and appearance.

If, instead of the street gas or carbureted hydrogen, pure hydrogen be used, sent through the platinum tube in a dry and pure state, the temperature can be brought near to the fusion of platinum without altering the diamonds, and their brilliancy and polish appear to be benefited by this extreme heat. With carbonic acid the diamond loses some of its polish and weight; the carbonic acid is decomposed into oxygen and oxide of carbon. Mr. Morren believed at first that this decomposition was due to the diamond, but he noticed afterwards that it was due to the white heat to which the platinum was brought, acting in a similar way as water in the Grove experiment; at this high temperature the diamond would burn in the presence of the liberated oxygen.

Great pains have been taken to obtain the combustion of the diamond; mirrors, powerful lenses, etc., were used; it is only necessary to burn it in free air, to place the diamond on a thin platinum sheet, and to bring this sheet to a red heat by means of the blower's gas lamp. The diamond takes fire immediately, similarly to a piece of coal, and burns away, and continues to burn if care be taken to continue to heat the platinum sheet which serves as a support.

In all these experiments, the diamond remains perfectly polished, and does not blacken nor split.

If the combustion of the diamond be stopped, the angles of equilateral triangles, are visible, by microscopical examination. They belong to octahedra, placed on each other, and arranged with precision in a way to refract, towards the eye, the light of all the similar triangular surfaces. All diamonds do not present a similar structure; the diamond with a curved face, used for cutting glass, represents, after burning, long prisms or fibers, terminated by equilateral triangles.

THE APPROACHING FAIR OF THE AMERICAN INSTITUTE.

The fortieth annual exhibition of the American Institute will be opened in the Empire Rink, at Third avenue and Sixty-third street, on Monday, Sept. 7th, at 12 M. In addition to the 80,220 square feet of floor, in the Rink as it was last year, at least 13,000 square feet of floor will be added on Third avenue, where a building 48 by 100 feet will be erected. The addition will be chiefly appropriated to the department of fine arts, and will be two and a half stories high. We trust that some attention will be paid to the architectural effects of the new structure, so as to conceal as much as possible the conspicuous ugliness of the Rink. The Board of Management of the Institute have decided to present no medals to exhibitors hereafter, except its great Medal of Honor, which can only be awarded to the discoverer or inventor of a machine, product, or process so important in its application as to supplant any article previously used for the same purpose, or at least to work a favorable revolution in some branch of the useful arts. This decision is in accordance with the precedent established in Paris in 1867. The French Commissioners found great difficulty in reconciling the vast conflicting claims of exhibitors of really meritorious objects; and one of the first steps taken to diminish the complication was to establish the principle that the "grand prize" should only be accorded to the discoverer or inventor of something entirely new. There was, however, an unfortunate want of uniformity in the different groups, as several of them declined to accept the new principle, and proceeded to grant awards according to ancient custom; and much confusion has thus resulted in the interpretation of the prizes gained by exhibitors. For example, the group jury of Group 1, adopted the new principle, and although the class jury desired to make some distinction in the matter of pianos, their request was overruled by the group jury on the ground that pianos were not a new invention. If the class jury had carried their point, we should not have had the amusing controversy which now wages as to who really obtained the highest premium at the Paris Exhibition. We happen to know that the class jury unanimously accorded the highest medal to one manufacturer of pianos, that the above statement is the true explanation of the reason why the firm did not receive it, but were placed on the same footing with one or two others. In other groups, exhibitors were more fortunate, as the rule was not established confining the highest prize to something new. Ths principle of conferring the Medal of Honor to a new inventor is doubtless the correct one, and will prevent the too frequent and cheapening distribution of prizes. It does not necessarily follow that the grand medal shall be given every year. Great inventions come slowly; and when they are made, a vast hive of smaller industries clusters round them. Bye and bye, another great invention is made; a swarming takes place, carrying off many industries to form a new hive, and the characteristic difference between our age and former times is the frequency in which this swarming now takes place as compared with past eras.

The grand medal can be safely accorded to such inventions as the printing press, the steam engine, the electromagnet, the power loom, the cotton gin, the barometer, the thermometer, the spectroscope, or to such discoveries as the law of gravitation, of the principle of dialysis, of dissociation, of the laws of combustion; and so on through a long list of inventions and discoveries which have brought the sciences and arts to their present high perfection. The Medal of Honor should only be awarded upon the unanimous vote of the Board of Management, and the rules to be observed should be accurately defined before the vote is taken. By undeviatingly adhering to these rules, the Institute may be able to put this medal upon the basis of the highest distinction to be obtained by an inventor in this country. The award to be given to the exhibitor of meritorious articles will be a handsome official copy of the judges' report, made upon the particular merits of the exhibited article, without comparative reference to other articles on exhibition. Each tub will be left "to stand on its own bottom," and invidious distinctions need not be drawn. The chief difficulty to be encountered here is to find competent judges who are willing to serve on the juries. The famous cat which was inveigled by the monkey into snatching the chestnuts from the fire may be taken as a fair prototype of the average juryman who decides upon the value of a man's wares: he is pretty sure to burn his fingers whichever way he decides. It is at best an ungrateful task, and we are not surprised that so many persons hesitate to accept it.

We are aware that the Board of Managers spare no effort to secure the services of competent judges. They prepare their lists early in the year, and issue the summons months before the opening of the Fair; and as one after another declines to serve because "he has read the papers," or "formed an opinion," or "is otherwise engaged," or "is afraid to face the wrath of unsuccessful competitors," they fill up the breach as rapidly as possible, so as to be ready before the grand opening day. It would therefore scarcely be astonishing if some persons who "did not know chalk from cheese" were smuggled on to "the intelligent jury;" though we have yet to learn of any such instance.

The American Institute is really a great public benefaction. It is not a private affair, but established in the interest of the whole people, and ought to be sustained in the most liberal manner; and those who have a knowledge of particular branches of machinery or products ought to be willing, for the common good, to give a little gratuitous service when invited by the Managers to do so. It is desirable to make the judges' report positively valuable; and in many instances, we can conceive of a public benefit to be derived from the publication of a well digested and ably written report upon some of the newer inventions, processes, or machines likely to be exhibited at the forthcoming Fair of the Institute.

The Board are confident that this exposition of American industry can be made to surpass any that has preceded it; and we trust that in this expectation they will not be disappointed.

THE PATENT AGENCY BUSINESS.

It is doubtless known to most of our readers that Messrs. Munn & Co., publishers of this paper, have for nearly twenty-five years carried on the business of soliciting patents for inventors, in this and foreign countries. Their aim has been to conduct this branch of business in a straight-forward, prompt and efficient manner, always keeping in view the best interest of their clients. How greatly they have succeeded will be understood when we say that, at the present moment, the number of patents obtained through the Scientific American Patent Agency nearly equals, if it does not exceed, that of all the other regular patent agencies in the United States combined.

The most flattering testimonials are constantly received by Messrs. Munn & Co. from their clients in all parts of the country, certifying to the excellent manner in which their business is transacted. We should be happy to publish all of these testimonials did space permit. As it is we must be content with an occasional selection, and here is one from Mr. P. H. Wait, Hydraulic Engineer, manufacturer of the celebrated Hudson River Champion Turbines.

Office of "THE BAKER'S FALLS" IRON MACHINE WORKS,
Sandy Hill, N. Y., August 5th, 1871.

Messrs. MUNN & Co.,

Gentlemen:—Your favor bringing notice that my Patent for Improvement in Turbines and Gate is allowed, is received. Please accept my thanks for the prompt and energetic manner in which you have worked my claims through. This is the fourth patent which you have engineered for me. There has been frankness, ability, and an exertion for my interest manifested in all of your transactions, even beyond my anticipations. I would advise every one having business to transact at the Patent Office to put it into your hands.

Yours truly, P. H. WAIT.

AN English coach painter lately wrote to a brother residing in this country, asking of him, that he would ascertain what method American painters adopt in order to produce the brilliant finish which he had noticed on American coaches sent over to England. The reply was "the Americans build up a firm foundation, free from tackiness, and the finishing coat thereby retains all its brilliancy. At home you use every coating too elastic, from the priming up."

ELECTRICAL ORGAN BLOWERS AND SEWING MACHINE MOTORS.

We recently examined, at the organ establishment of Mason and Hamlin, Broadway, New York, an interesting example of the practical application of electricity as a motor for operating the bellows of organs. It consisted of a diminutive, but powerful rotary electromagnetic engine, which was attached by connecting rod to the bellows' lever of a large parlor organ. A battery of twelve cups was employed. The organist has only to touch a key, or a stop, to set the machine in motion.

This engine was made under Gaum's patents. It consists of a series of fixed magnets, arranged radially upon a common center. A wheel, in the form of an open frame and carrying a series of armatures, revolves around the magnets, the wheel being put in operation by the alternating attractions of the several magnets upon the several armatures. The breaking of the electrical currents is accomplished at the proper moments by a commutator or arm, which is carried by the armature wheel.

The construction of the engine is simple, and its operatio for this purpose apparently quite effective.

We have also seen a smaller size of this invention applied to the driving of sewing machines with much success. The electro-motor is attached to the underside of the sewing machine table, and is so small as not to be noticeable.

To start or stop the sewing machine a small key is touched.

An improved form of battery, the invention of Mr. L. Bastet, is used in connection with these engines, by which the expense of working is greatly reduced. We believe that 25 cents a day, and even less, is the estimated expense of working a sewing machine.

There is a large variety of purposes to which these small electro motors can be applied with advantage, and we have no doubt that they will come into extensive use. They are made by the Electro Magnetic Engine Co., at the Woodward Co.'s establishment, corner Center and Worth streets, New York.

A NEW BLEACHING PROCESS.

Our readers will remember an article published on page 402, Vol. XXIII. of the SCIENTIFIC AMERICAN, describing a new printer's ink introduced into this country by Leopold Mendelson, of 76 Nassau street, New York. This gentleman has just patented a new bleaching process for discharging the ink alluded to from paper stock, but which has also an extensive application to the bleaching of other fabrics.

The process is also claimed to restore the fiber of paper so that, when remade after bleaching, it is even firmer and stronger than the original stock. If these claims are substantiated upon the introduction of the process, it will prove of great importance to paper manufacturers, and will greatly add to the value of the Kircher's printing ink as well. The invention consists principally in the application of chlorine to the fabric or paper stock to be bleached, the chlorine being produced during the bleaching process by an apparatus connected with the agitator, through which arrangement the process is so simplified that, the inventor claims, the cost of bleaching is very greatly reduced.

Manganese and muriatic acid in equal proportions are used to generate the chlorine gas; this is conducted to a second vessel where it is washed with water. The purified gas is then passed into the third vessel—the agitator—and applied to the substances it is desired to bleach.

The amount of chlorine evolved is regulated according to the quantity needed on any particular occasion, while the rapidity of admission of the purified gas from the washing vessel to the agitator is nicely graduated by a suitable cock.

Overland Telegraph between Asia and America.

In consequence of the high pitch of perfection which has now been attained in the manufacture and working of submarine cables, it may be questioned by some whether it will ever be worth while to carry an Asiatic and American telegraph so far north as Behring's straits, merely for the sake of having a somewhat shorter cable, which was the reason which induced the projectors of the Western Union Extension Company to adopt this route. On this point Mr. Kennan says: "I believe that this is a much more practical route for a line to China than the one recently proposed by Mr. Collins, *viâ* the Aleutian Islands, Kamtchatka, and Japan. Labor in Siberia is very cheap, and almost any desired number of men can be engaged at Yakootsk for about forty dollars a year and subsistance. Horses can also be purchased at Yakootsk and Kolyma to the number of five or six hundred, at prices varying from fifteen to twenty-five dollars. Nothing need be brought except wire, insulators, and tools, and a small quantity of provisions for a limited number of foremen. If there were any call for it, I believe that a line could be successfully built from Behring's straits to the Amoor river, in two years, at an expense not exceeding $250,000.

THE last sitting of the *Académie des Sciences Morales*, Paris, was occupied by a discussion raised by M. Egger on the degree of perception and intelligence in children. The question is to ascertain if infants are inferior or superior to ordinary animals in their mental condition. The reasoning of the learned member was grounded more on theoretical grounds than on actual observation of facts. None of the arguments offered were supposed to be conclusive, and the problem is left open for future investigations.

[Special Correspondence of the Scientific American.]

INTERESTING EXTENSION CASES.---NEW RULES AND REGULATIONS.

Washington, D.C., August 7, 1871.

In the extension case (patent for a double plow), of the administrators of the estate of Arnton Smith (deceased), referred to in a previous letter, Commissioner Leggett has just rendered a decision adverse to the applicant, on the ground that neither the inventor nor the other parties interested have made any diligent effort to manufacture under the patent, or to issue licences or prosecute infringers, and that a continuance of the protection would be decidedly detrimental to the public interest.

The Commissioner has also refused the application for an extension of Levi Bissell's patent for a locomotive truck. The original patent was granted not only with a very limited claim, but after being rejected by the Examiner and the Board. In 1864, the assignees obtained a reissue, in which much that was originally required to be struck out was reinstated, which action of the office is condemned by the present Commissioner as well as by the present Examiner, Mr. E. Spear.

A patent for the same invention was granted to Bissell, in England, three months before the American patent was issued, and the Commissioner considers it very questionable whether, under the law of July 8, 1870, an extension under any circumstances could properly be allowed. The act referred to provides that "no patent shall be declared invalid, by reason of its having been first patented in a foreign country," but "it shall expire at the same time with the foreign patent." The previous Commissioner, Mr. Fisher, in all his rulings subsequent to the passage of this act, held that, though the law did not intend to affect those patents already granted at that time, yet it does prevent the extension of such patents when the original term expires, otherwise it would be a continuation in this country of a monopoly which has terminated abroad. In one of his decisions involving this question, Mr. Fisher says, "whether the section does or does not actually forbid the extension, it so clearly declares that the American patent shall not survive the death of the prior foreign patent, that a decent respect for the declared policy of the legislature would determine an officer, while exercising his discretion, to exercise it in accordance with that policy, and not in opposition to it."

On the other hand, it is urged that the law was intended only to reach the case of the foreign inventor who first patented his invention in his own country, but not to put the American inventor who obtained a patent abroad in a worse position than if he had obtained no patent at all in a foreign country. It is also urged that, if the American patentee had not obtained an English or French patent, the invention would be free in those countries, even during the lifetime of the original patent, and that the fact that it was free there would be no bar to the grant of an extension. The object of Bissell's invention is to prevent the locomotive from running off the track by holding the truck always at right angles to the rail, whether on a curved or straight track, and so preventing it from swinging around in case of meeting with any obstruction. In 1858, fifteen months after the above patent was issued, the applicant received another for substantially the same invention, the only material difference being that the devices were applied to a two wheeled instead of a four wheeled truck, so that practically the first patent is extended for that period under the second.

The application for an extension of the patent to Nicholas and Bly, for an artificial leg, has also been refused, though no opposing testimony was filed. The Examiner, in his report on the case, takes the ground that the invention was not new when patented, and was anticipated in part by an English patent to J. Potts, as far back as the year 1800; and also in the American patents to O. D. Wilcox and B. W. Jewett. The device is a universal joint, connecting the foot and leg pieces, with spring tendons to keep the articulating surfaces in constant co-aptation.

Four extensions have just been granted, namely, to W. M. Ferry, Jr., for an improvement in saw mills; to W. P. Fee, for a cotton seed huller; Alfred Monnier, for manufacture of sulphuric acid; and Charles Winslow, for elastic gore cloth. The leading feature of Ferry's invention consists in causing the saw to cut toward the log instead of toward the slab or board, while cutting cross grain stuff, by giving it a slight obliquity to its usual line of movement parallel to the edge of the log carriage.

Fee's huller has proved a valuable invention, as the machines previously used had more or less of a grinding or crushing action, by which the hulls, kernels and fibers became packed, thereby choking the mill and rendering the process of securing and of expressing the oil very difficult and incomplete. Fee uses, and with great success, a series of cutting edges with deep intervening furrows. By this simple action of cutting the hull, it is readily separated from the kernel, and the grinding pressure is avoided.

Before Monnier's improvement in the manufacture of sulphuric acid, it was common to pulverize and burn iron pyrites and other natural metallic sulphurets with a free supply of oxygen from a draft or blower, the product being sulphurous acid, which contains one proportion of oxygen less than sulphuric acid; and to obtain the needed additional measure of oxygen it was common to continue the burning with nitrate of soda or potash or with nitric acid. This process was attended with a great loss of the sulphur, only about 30 or 40 per cent being secured. To the above processes, Mr. Monnier added that of mixing the pulverized sulphuret, before burning it, with 33 to 75 per cent of caustic soda, or carbonate or sulphate of soda, or sulphate of lime or other salts, by which means nearly all the sulphur is saved.

Of all the acids used in the arts, this is the most important, and on account of its superior attraction for bases it is employed for obtaining almost all the other acids. Though still imported, its manufacture in our own country has become very extended.

The extension of the Winslow patent was strongly contested by the National Rubber Company, of Providence, R. I. The invention is an improvement on what is known as the Tyer and Helm cloth, patented in 1856, and extended in May, 1870; and consists of a rubber or gutta percha fabric, as described in that patent, provided with an elastic binding produced by turning over the edge of one of the pieces composing the fabric so as to cover the edge of the other. This binding strengthens the fabric, and is at the same time elastic in the direction required for making the gores of shoes, etc. An ordinary binding would not answer the purpose, as it would be elastic in the wrong direction. The warp and weft in each piece cross each other diagonally, and the edges are cut and overlapped in lines parallel to the weft, and at acute angles to the warp, and is then cemented to the fabric. The invention is of great value, especially in the manufacture of the well-known Arctic overshoe.

NEW RULES AND REGULATIONS.

The Commissioner has just issued a new set of "Rules and Regulations" to accord with the revised and amended law approved July 8, 1870, and modified March 3, 1871. Some of the more important new features in the office practice are found in sections 11, 42, 44, and 45; and the portions embodying them read as follows:

11. In case the applicant by amendment either enlarges the scope of the claim or claims first filed, or sets up new claims, he will be required to file a supplemental oath relative to the invention as covered by such new or enlarged claim or claims; and such supplemental oath must be upon the same paper which contains the proposed amendment.

42. Every applicant for a patent or the reissue of a patent, any of the claims of which have been twice rejected, may appeal from the decision of the primary Examiner, in such case, to the Board of Examiners-in-Chief, having once paid a fee of ten dollars. For this purpose a petition in writing must be filed, signed by the party or his authorized agent or attorney, praying an appeal and setting forth the reasons upon which the appeal is taken.

This statement of the reasons of appeal should point out distinctly and specifically the supposed errors of the Examiner's action, and should constitute a brief of the argument upon which the applicant will rely in support of his appeal.

Before the appeal is entertained by the Board, this statement will be submitted to the primary Examiner, who will make answer in writing touching all the points involved therein, and who will specially indicate in what particulars, if any, the reasons of appeal fail to represent correctly the issue between the applicant and the Office.

44. All the claims must be passed upon and all preliminary and intermediate questions must be settled before the case is appealed to the Board.

45. Cases which have been deliberately decided by one Commissioner will not be reconsidered by his successor upon the same state of facts. They may, however, be reopened in accordance with the general principles which govern the granting of new trials.

More explicit directions in regard to the preparations of the drawings are given; and hereafter the copies furnished by the office will be executed by the photo-lithographic process.

Meeting of the New York Canal Commission.

The Commission appointed by law to examine inventions, and apportion the reward of one hundred thousand dollars for improved canal boat propulsion, lately held their first meeting at Albany, N. Y.

The Commission consists of Geo. B. McClellan, Horatio Seymour, Erastus S. Prosser, David Dows, George Geddes, Van R. Richmond, Willis S. Nelson, George W. Chapman, William W. Wright and John D. Fay.

Van R. Richmond was elected Chairman, H. A. Petrie, Secretary, David M. Greene, Engineer.

The following resolutions were adopted:

Resolved, That for the purpose of carrying out the intent of the law, this Commission will require, among the tests to be made, that the several competitors shall make not less than three round trips from New York and Buffalo or Oswego, each boat to be loaded with not less than two hundred tuns of cargo each way, the trips to be commenced as soon as any party is ready and all completed in the least practicable time. For the purpose of determining the time consumed by each and all the trips, the clearance must show the day of the month and time of day that the boat passes each Collector's office; certified copies thereof to be furnished the Commission. In order to obtain information in regard to the practical working of the several devices in competition, as soon as practicable, the engineer of the Commission, David M. Greene, of Troy, will inspect the same from time to time, as in his judgment may be necessary, and report the facts obtained to this Commission.

Resolved, That competitors are hereby notified that, for the purpose of carrying out the intent of the law, though it is desirable that the three consecutive round trips from Buffalo or Oswego to New York be made at the earliest time practicable, that the whole of the year 1872 will be allowed to such persons as may desire so much time, and that the awards will not be made until the close of navigation in that year.

The next meeting of the Commission was fixed for August 14th, at the office of the Canal Commissioner, Syracuse, N. Y.

Persons who desire to communicate with the Commission, should address Henry A. Petrie, Secretary, office of the State Engineer, Albany, N. Y. The law in full was published in the SCIENTIFIC AMERICAN of May 6, 1871.

A NEW IDEA IN SAFES.

Mr. S. Morris Lillie, of Elizabeth, N. J., proposes, by means of a new invention recently patented by him, to circumvent burglars in their attacks upon safes. He constructs a safe having within its walls strong receptacles, into which he introduces powerfully compressed or liquified poisonous gases, so that when these chambers or branches extending therefrom are penetrated by the burglars' drill, the gases shall escape and vitiate the air around the safe, and the operations cannot be continued. Branch pipes sealed with suitable fusible plugs are also provided, so that in case of fire, the melting of the plugs will allow the escape of the mephitic gas or gases to extinguish the fire.

The idea of preventing burglars from working in this way is ingenious. The escape of a small quantity of carbonic acid, carbonic oxide, sulphuretted hydrogen, or other gases that might be employed for this purpose, would so vitiate the air of a close room that no one could work in it, and our readers are generally well aware of the power of carbonic acid to extinguish fire. Whether the ingenious fraternity of burglars will be able to match the inventor, by the exercise of equal ingenuity, time will determine.

THE WESTFIELD EXPLOSION.—THE QUESTION ANSWERED.—Mr. Levy F. Smith, of Philadelphia, has cleared up the difficulty about the cause of the boiler explosion on board the *Westfield* ferry boat. His evidence is to the effect that he supplies steamboats with appliances for boilers, that he examined the sheet where the fracture commenced, and he believed it never was first quality iron. That "my opinion is that the explosion was caused by the igniting of gases in the boiler."

Q. "What gases were there?"

A. "Steam is a gas."

Q. "Was there any other gas there besides steam?"

A. "It may have been oxygen."

Examples for the Ladies.

Mrs. A. F. Hall, of Wellsville, N. Y., received 10 years ago a Wheeler & Wilson Machine as a bridal present, the most valuable of her gifts, not excepting a check for $500; it has done all the sewing for her own, her father's and her sister's families, without a cent for repairs, and but two needles broken.

The Pittsburgh (Pa.) *Leader* says: "The firm of George P. Rowell & Co. is the largest and best Advertising Agency in the United States, and we can cheerfully recommend it to the attention of those who desire to advertise their business scientifically and systematically in such a way; that is, to secure the largest amount of publicity for the least expenditure of money."

After Sea Bathing, use Burnett's Kalliston to relieve the disagreeable action of salt water.

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.

CANNING FRUIT.—In answer to S. H. P. as to the best method of exhausting air from jars, to preserve fruit, etc., I would say the best way is to have the jars hot to begin with, then put in the fruit as hot as possible, and stop the jars hermetically as quickly as possible. I have put up fruit for the last fifteen years with perfect success. At first I used an air-pump, which answered well, but no better than the means above described. The philosophy of it is this. Air, by heating, expands many times its own bulk; consequently, if you take a jar and cover it tightly with the exception of a hole the size of a pin through the cover, and set it in boiling water as air expands twenty times its bulk by heating, it is obvious that 19-20ths of the air passes out through the pin hole in the cover; now drop a little sealing wax or solder over the pin hole and you have but 1-20th of the air in the jar that was in it before heating it. Of course the fruit and syrup, if put into the jar cold, displaces most of the air; but putting it in as hot as it can be, and filling as full as possible, expels the air to all intents and purposes. I have frequently had cans, managed in this way, when made of sheet metal, collapse from outside atmospheric pressure as they cooled off, which showed that the exhaustion was complete.—G. W. N., of Ga.

BELTS.—In your paper of July 29, in answer to L. B. G., you say: "There is no rule for locating fixed pulleys on shafts placed in the same plane, but inclined to each other. A belt will not run on pulleys so placed." I have seen one running for years almost at right angles; but there is an upright shaft at the point where lines would cross if drawn from the face of each pulley, carrying a tight and loose pulley, around which the belt runs. Of course, the upright pulleys run in opposite directions. It is very simple where driver and driven pulleys are of equal size, and run in the same plane or level; but it can be done when they are of different diameters, in different planes, or at different relative distances from the floor. If this is what L. B. G. wants, I will give it to him at some future time. And as to belts running in the same parallel, but not in the same plane, or rather where the shafts are so placed, all that is necessary is to reduce the highest end of the driven pulley, so that the belt will draw straight from one shaft to the other, more or less, according as one end of the shaft is more or less raised above the level of the driver.—J. E. S., of Me.

CUTTING GIMLET POINTED SCREWS.—The screw blank is clasped by a pair of revolving jaws which hold it by the head. Next a cutter is swung round on a pivoted arm and shaves the point to the proper taper. As soon as the point is shaved this cutter swings back out of the way, and the cutter for the thread begins its work. The thread cutter commences nearest the head of the screw and passes toward the point as the screw revolves, taking a light chip. Then it is released and flies back towards the head, and starts with another chip. This is repeated until the screw is cut to the proper depth. For cutting the longer screws, a grooved rest is held against the side opposite the cutter to keep the screw from springing. I have given a general description without details. No dies are used.—G. A. B., of R. I.

FROST PROOF BUILDING.—W. S. H. inquires how to build a frost proof room above ground. I believe the best way to do it would be to build double walls and roof, the farther apart the better, and fill the space with saw dust or similar material. The outside walls and roof, I would make of rough boards, and cover with tin as near air tight as possible. This will stop the circulation of the air, and rats. Dig the earth out of the inside as deep as convenient, or sink a well hole in the center. Floor over level with the ground, leaving a little space between the edge of the floor and the wall for the warmth to rise through. The filling between the walls should go some distance below the surface; or if the ground be wet, cover a few feet out from the wall with straw or something that will keep out frost.—F. A., of Iowa.

SALT IN SOAP MAKING.—In answer to C. F. M. in regard to use of salt in making soap, I cannot give him the formula of Mr. Alex. T. Macrae, but I will give him my own if he wishes to try it. Let him use good lye from hickory ashes, or "concentrated lye," and the usual amount of soap grease, and make his soft soap in the ordinary way, boiling it well. Try it as it progresses, and when it gets to a proper jelly consistency, upon cooling, add common salt, and try it after the addition, until upon cooling it gets quite firm and hard; then pour the whole kettle full out in some receptacle so as to allow the soap to be about four or five inches in depth. Let it cool, and then cut in blocks and put in a *dry* place, and he will find it improve by age. A little practice will be all he requires to get the proper proportion of salt to be added.—R. S. S. H., of Md.

MARINE GLUE.—In response to J. H. P.'s request in regard to marine glue, (in the issue of 22d inst.), I must refer him for a more accurate formula for preparing it to Tomlinson's *Encyclopædia of the Arts and Sciences*, article on glue and shellac. I have not the book at hand, and it is years since I have seen it, but I have made marine glue by its formula. The ether used must be perfectly free from alcohol, as that fluid acts as a precipitant upon india rubber. Heat, however, must be applied in hastening a solution, the best means for so doing being the sand bath. [In my article on glues, you made me say "take the scales" of certain fish; I wrote, "take the skins."]—F. L. J., of Ark.

FROST PROOF BUILDING.—My father's plan is to put oak sills level with the ground, so that no air can get under them. He then puts up the frame in the ordinary way, weather boards it, and sheets it on the inside with tongued and grooved plank, and then fills the space between with sawdust or tanbark packed tight. Before putting the sawdust or tanbark in, it is best to put six or eight inches of cinders from the blacksmith shop, to keep the rats from cutting through. The floor above should be tight to exclude the wind. My father has kept apples, potatoes, eggs, etc., without freezing, in a house of this kind for 13 or 14 years.—J. V. J., of Ontario.

RELATIVE POWER IN BORING AND TURNING.—G. S. R. does not give hight of point above the shank of his tool, nor does he say whether the cylinder remains firm. However, I do not think that it does or can take more power to bore a 16 inch cylinder than to turn a 16 inch pulley, provided every thing be right in both cases. In outside turning, the shank of tool stands at an obtuse angle with the work, above the tool, giving somewhat near an end thrust, in direction of the shank, and is therefore not liable to spring into the work. Inside turning or boring the tool stands at an acute angle with the work, ahead, and is very liable to spring in if not of proper shape, or if not set right; when, if the belt does not slip, something must give. If he will use a side tool, as in diagram, from ¼ inch

to 1 inch ahead of center, clamped firm, I cannot see why he should have any more trouble. As to speed, if the length of cylinder is same as face o pulley, and inside of cylinder be free from sand, as pulley, I see no necessity for any variation.—B. P. G., of Mass.

RELATIVE POWER IN BORING AND TURNING.—Answer to G. S. R., query 1, July 22.—The reason that more power is required to bore a cylinder than to turn a pulley is because of the difference of angles at which the chips are to the cut. The curve in the cylinder tends to thicken and support the chip in advance of the cut, while that of the pulley reduces and weakens it.—E. S. W.—[We have received many letters on this subject, but as they are to the same effect as E. S. W.'s, it is unnecessary to print them. The opinion expressed is undoubtedly the correct one. Moreover, the difference in the required power increases as the diameter of the cylinder diminishes, as lessening the curve of the surface facilitates external and retards internal cutting.—EDS.]

SMOOTHING STEEL WITHOUT FILING.—I have done a great deal of such work by first turning and then grinding, revolving my axle on centers, and grindstone on bearings. Of course the face of the stone needs to be less than one half the width of the length of the bearing; and the same time both axle and grindstone are rotated, the shafts or axle or grindstone must be reciprocated properly. If properly done, the metal is much more perfect than if filed.—H. J. H., of N. Y.

PUTTING UP FRUIT IN GLASS.—S. H. P. will find the following entirely satisfactory. Simply place a common table spoon in the jar before pouring in the boiling hot fruit; pour until the jar is full, then remove the spoon and fill the vacancy caused by its removal. Fasten the jar at once, as usual, and the fruit is safe. I put up thirteen dozen in this way last year, and not a single jar broke, nor was any of the fruit spoiled. L. C.

FINISHING WALNUT.—H. W. M.—For filling walnut wood, there are many compounds in use, several of them under patents; that which discolors the wood the least and at the same time produces a fine finish, is the most simple of them all, being nothing but fine rye flour mixed with boiled oil, japan and turpentine, ground fine in a paint mill, and slightly colored with burnt umber.—C. T., of Vt.

A. L., of Mass.—We believe that the theory of cushioning by exhaust closure is sound both in theory and practice; and also that the use of independent cams and eccentrics for this purpose is the better way when it can be done conveniently. At the same time it may be advisable on some engines to give some lead to the induction valves in conjunction with early exhaust closure.

WASHING ETHER.—Turn the ether and water into a glass funnel, while you hold a finger to the end to prevent anything from running out. The ether rises to the top, the water and residue fall to the bottom. Take away your finger from the funnel and let the water out; then save your ether. It is almost as simple as saving washed oil.—H. J. H. of N. Y.

OILING BELTS.—A good way to oil belts is to pour the oil on to the inside of the belt as it runs, and let the pulleys work it in. It may be put on freely if the belt be running idle, but if at work it will take but a small quantity at a time without slipping. Keep the leather just oily enough to make it pliable.—O. A. B., of N. Y.

COATING IRON MOLDS.—G. J. C. asks what to coat iron molds with to produce good smooth castings. If he will smoke his molds well before pouring his metal, I think he will find no trouble. I am no molder, but have seen it done with the desired effect.—C. H. C., of N. Y.

QUARTER TWIST BELTS.—In answer to J. E. D.'s query about quarter twist belt holes, (July 29), you make me say:—Moreover, J. E. D. will find it economical, etc. It should read: moreover, J. E. D. will not find it economical, etc.—F. H. C., of N. Y.

BELTS.—Answer to J. E. G., query 10, July 22.—If two shafts in the same plane, but not parallel, are belted together, the belt will run towards the ends that are nearest together.—E. S. W.

LINING IRON VESSELS.—J. H. P.—Tin is the best material for lining iron pots and kettles. They can be easily retinned when required. The process laid down by McKenzie is effectual and very simple. His book will be found in almost every library.—C. T., of Vt.

CHEAP HORSE POWER.—E. G. A.—The best of "cheap horse powers can be made by erecting an upright shaft with sweep, and a large drum attached to it. Gear up with smaller drums to any speed required —C. T., of Vt.

SIZING FOR GILDING.—M.—The best sizing for gilding on glass is made as follows: Put a piece of isinglass as large as an old fashioned cent into a teacup; fill half full with boiling water. When well mixed, and before cold, fill nearly full with spirits of wine.—C. T., of Vt.

C. M. R., of N. H.—Were we about to transmit power from a prime motor through a distance of 650 feet we should use a telodynamic cable, or wire rope belt, unless it were requisite to take off power along the line of transmission, in which case we should use a shaft.

E. M. F., of Ohio—The maximum velocity of rivers, creeks, etc., is in a vertical plane where the water is deepest and at a point somewhat below the surface, the distance below depending upon the depth of the stream, incline and character of the channel, bottom, etc.

M. H., of Mass.—The so called sweating on the outside of vessels containing liquids is caused by the condensation of atmospheric moisture thereon. Outside moisture will not strike through air tight metallic cans.

J. N., of N. B.—The valve of your engine, is evidently from your description, not properly set. You should obtain the advice of a competent engineer and have him indicate your engine and adjust it properly.

Declined.

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

QUERIES—T. H.—V. W. K.—R. P. K.—and G. A.
RELATIVE POWER IN BORING AND TURNING—F. A., J. W. B., and W.
CANAL NAVIGATION—B. W. H., and C. T.
KEEPING FLIES FROM HORSES—J. G. T.
SPEEDY AND QUICK TRANSPORTATION—H. C. J.
NEW BOAT TO RUN UPON LAND AND WATER—J. M.
RUNNING OF BELTS—W. G. B.
PRACTICAL NAVIGATION OF THE AIR— ———.
CHINESE PUZZLE—F. A.
PAINE'S MOTOR—C. T.
STEAM PLOWING MACHINE—E. C. H.
SPIRITUAL PHENOMENA—R. H.
THE IMMORTAL INVENTOR OF THE TELEGRAPH ON STORM AND FLOOD SIGNALS—A. W.

Business and Personal.

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Queries.

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

1.—SETTING BOILERS.—Will it be safe to place a forty inch two flue boiler, twenty-four feet long, alongside of two forty-eight inch tubular boilers, fourteen feet long, all to be heated together in the usual way, and connected as usual by steam and mud drums?—W. E. H.

2.—TORTOISE SHELL.—What is the best method of preparing tortoise shell for pressing in molds?—C. L.

3.—DRESSING SKINS WITH THE HAIR ON.—Will some one please tell me the best mode of dressing hides with the hair or fur on?—J. S. P.

4.—COLORING COPAL VARNISH.—Can any of your readers tell me how to color copal varnish, so that when applied to wood which has not been stained, it will present the color of black walnut or other dark wood?—Mc. H.

5.—VESSEL FOR COOKING TOMATOES.—What is the best kind of metal to use in making a vessel to manufacture tomato catsup? We have used tin, but find the action of the acid of the tomato soon uses it up. —I.

6.—CEMENT FOR PAPER.—Do any of your readers know of any glue, cement, or mucilage with which paper, cloth, etc., can be pasted together, so that hot oils cannot percolate through the joints?—A. I. M.

7.—BATTERY.—Nemo talks to the point on the battery question. I should like to hear from him as regards the following: Would not a carbon plate, instead of the copper, in the bichromate solution, give the same quantity and more intensity? Is the bichromate solution identical with the battery fluid sold commercially as electropoin? Does the bichromate solution give off fumes, so as to make it undesirable in a dwelling house?—NEUTRAL.

8.—GALVANIZING WIRE SPRINGS.—Can any of your readers give me a recipe for galvanizing or zinc coating wire springs, without heating them so as to impair the temper?—O. A. B.

9.—DRIP PIPE OF STEAM HEATER.—Will some of your readers explain why it is that in fitting up a building with steam for heating purposes, the drip or return pipe connections are always made below the water line in the boiler? Is this necessary? If it is, would they be kind enough to say a word or two on the subject?—A. S.

10.—SHADING BRONZE.—Will some of your readers tell me the best and easiest way of shading bronze?—G. N. R.

11.—GRINDING ORES.—Can any one tell me which is the best kind of mill to use for grinding iron ores; the Chilian or other?—J. A. T.

12.—BOTTLING CIDER.—Will some of your many correspondents give me a recipe for bottling and preserving cider during the winter? I have drunk cider put up North which tasted like champagne.—F. L. J.

13.—LEAKAGE OF PAILS.—Can any of your readers tell me why a common wooden pail which is perfectly tight when containing water should leak or soak through when containing whitewash or lime and water —J. B.

14.—CONE PULLEYS.—I wish to belt from a cone pulley of three steps, sixteen, fifteen, and fourteen inches in diameter, to another the smallest pulley of which is one inch in diameter. What size must I turn the two larger pulleys on the small cone, so that the belt shall run with equal tension on all the pulleys?—A. W. G.

15.—PARIS GREEN ON POTATOES.—Will the use of Paris green on potato plants poison the tubers, so as to poison those that eat them? It is held by many, and by some that should know, that such is the case. can see no difference in the quality or taste of them.—C. E. McR.

16.—POROUS CELL FOR BATTERY.—Can I, in a galvanic battery, use for a porous cell a sack made of soft leather? The battery is put up in the following manner: In a two gallon stone jar is fitted a sheet of copper; the jar is then filled with a diluted solution of sulphuric and nitric acid, one pound of the former and one half ounce of the latter for two gallons of water. For a porous cell I intend to take a bag or sack made of soft leather, to be filled with a concentrated solution of common salt, in which a zinc bar is to be immersed.—A. R.

17.—DEFECTIVE CASTINGS.—In the ornamental leaves of house columns I find the following defects: On the outside they are soft, while on the inside they are so hard that the drill will not touch them. The castings are not annealed. No. 1 foundery iron was charged in the cupola; the mold was made in green sand. The defect was noticed in drilling. I cannot account for the peculiar character of such castings, though I have noticed pigs of the blast furnace to be of the same description. I would be obliged if some practical founderyman would give the cause in the columns of your paper.—C. F. L.

18.—REVARNISHING.—Will some of your numerous readers give me directions for revarnishing furniture without removing the old coat of varnish?—H. G. W.

19.—SAND AND EMERY BELTS.—I wish directions for preparing sand or emery belts for finishing woodwork. I require something of the kind in the manufacture of my paper files (for which you procured me a patent), and do not know how to prepare it.—B. F. N.

20.—RESTORING GLUE.—I wish to ask, through "Queries," how to restore glue which has soured from some cause unknown, and will not dry?—E. S. C. B.

21.—DRAWING COMPASSES.—I have some fine steel pointed drawing compasses, the points of which have been blunted or turned. Can some of your readers inform me how to renew those points, still preserving the graduating angle?—J. E. B.

22.—GRAVEL WALKS.—What substance sprinkled on a gravel walk will kill vegetation? I have tried salt, but that does not have the required effect.—F. C.

23.—TABLE CUTLERY.—D. B., of N. Y., answers my inquiry about cutlery, that "my knives were made to sell, not to cut;" now in this connection all I can say is to reiterate what was in my original communication, namely, that I have purchased of the best and most reliable importers of the article in question in Baltimore, and taken "Rodgers'," "Wostenholm's," and "Butcher's" branded carvers, and they do wear for a short time, but the material seems to get entirely worthless. I profess to know something in regard to sharpening, and the use of the "steel," but the edge turns off at once, and I was anxious to know whether the use of scalding water, in which they are put by servants, had any effect upon the temper; and if so, whether the knives could be re-tempered?—R. S. S. H.

Recent American and Foreign Patents.

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

JAR MOVEMENT FOR ROCK DRILLS.—Hugo Sontag, of Osnabruck, Germany. The drill shank is made in the form of a cylindrical rod of suitable length. Its upper end is swiveled in a sleeve having projecting wings, and each wing having projecting ears. The shank is fitted into a tubular shell, vertically slotted to admit the wings of the sleeve. The tube or shell is suspended from its upper end, which is rigidly fixed to a rod suspended from a rope swiveled in a link connected with raising and lowering apparatus. On this rod is a vertically adjustable plate, whose motion up and down is limited by shoulders or pins. This is connected with the rope or chain, by which the plate and parts attached to it are lifted. From this plate are suspended two rods, which extend down the shell into projecting enlargements of the same. Each rod has two projecting ears near the upper end of the slot. Whenever the drill is let down and touches bottom, the ears strike the upper portion of the slots of the shell, and are moved on inclined edges into enlargements of the slots, and rest on projections of the shell. The drill being dropped into the rock, tripping mechanism unlocks the tubular shell, and the latter acts as a hammer upon the bit socket. The drill is then withdrawn, and the movement repeated; but if the bit becomes stuck and resists withdrawal, the tripping mechanism unlocks the shell which is drawn up, creating a jar that loosens the drill in its seat.

COMBINED SAD IRON AND RUFFLER.—William Banzett, Williamsburg, N. Y.—This invention relates to the combination with an ordinary sad iron of a pair of fluted rollers mounted in vertical standards, placed at the front and rear ends of the iron, said standards being also connected at their upper ends with the handle of the sad iron, the object of thus combining the iron and rollers being to furnish a ready means of fluting ruffles and other like articles after they have been ironed.

MUSIC LEAF TURNER.—Arthur W. Bush, and Marshall McComb, of St. Cloud, Mich. This is a combination and arrangement of various devices whereby an instrument is produced that may be easily attached to a piano, organ, or other key board instrument, and which will turn the pages of music as they are required, either by the use of the hand or foot.

HORSE HAY FORK.—Jacob Huy, of Bakerstown, Pa. This is a combination of pointed tube rod, springs, and shouldered and pivoted prongs, loop, pivoted lock, trip arrows and catch, by which a very compact harpoon fork is secured, and one which we judge will be very effective in use.

LAMP CHIMNEY.—Edward David Ashe, of Brompton, England. A new way of forming the upper section of the chimney of conducting and radiating material, which shall rapidly absorb the heat evolved from combustion, and convey it to an adjacent vessel of water, is employed. The metal section is made conical, and is suited for the reception of small sheet metal vessels having vertical central conical pipes through them, which may be put on for heating water or other substances. The lower part of the chimney is a short glass section, which is fitted to the lamp top in the ordinary or any approved manner, and in any approved form. It is provided with a cylindrical or slightly conical part at the upper end, to which is fitted the tin or other sheet metal section, so as to hold with sufficient power by the frictional contact. Immediately above the top of the glass section it is provided with the air holes for admitting air to the flame at or above the top, by which the combustion is made more perfect, smoking prevented, and the flame improved in brilliancy.

GRAIN SPOUT.—John O. Frost, of Candor, N. Y.—This is a new and useful improvement in spouts for delivering grain and similar commodities into bags; and consists in a sleeve made to slide on the spout by means of an eccentric or other analogous or equivalent device, the construction and arrangement being as hereinafter more fully described. When the sleeve is thrown down by the eccentric, the bag is fasteed between the collar and the end of the sleeve. When the eccentric is turned and the sleeve is thrown up, room is left for adjusting the bag over the collar. By this improvement no hooks are required, and, consequently, there is no tearing of the bags, or of the clothes or fingers of the miller. The inventor does not confine himself to this particular arrangement; the sleeve may be operated on the spout by means of a cam and without a hand wheel.

EARTH BORING AUGER.—This invention relates to a new and useful improvement in augers for boring wells, whereby it is claimed much valuable time is saved. It consists in forming the auger of a longitudinal section of a hollow cylinder flattened on its back so as to admit air, and provided with a cutting bit and circular lip, which receives and supports the column of earth when the auger is withdrawn. The bit works downward as the auger is revolved, and the earth which is thus undermined is left stationary with the auger, and when the pod or auger is full it is raised, and swinging, as it does, from a derrick, it is turned in a horizontal position with the open side down, when the earth drops by its own gravity. Water is used during the process of boring with this auger, which greatly diminishes the friction. Air is constantly admitted to the auger by means of a flattened space on the back, which prevents a vacuum being formed to retard or obstruct its withdrawal. With this auger the earth is, it is claimed, readily bored to the depth of a hundred feet or more. The auger is attached to the end of a wooden rod, to which the power is directly applied. There is a band around the semi-cylinder near the top, two inches under, more or less, the object of which is to support the load in the auger (tenacious clay, for instance), and prevent its discharge before the proper time. William Wheeten Jilz, of Hamilton, Mo., is the inventor of this implement.

APPARATUS FOR TRANSMITTING MOTION.—Edward H. Bancroft, of Syracuse, N. Y. This invention relates to improvements in apparatus for transmitting motion from the horizontal shaft of a wind wheel revolving around a vertical axis, or other powers having like action; and it consists in a connection of two cranks on the said shaft by connecting rods and cross heads, or slides with a pair of reciprocating rods, so that the cross heads or slides, and their supports which are mounted on the horizontally revolving frame by which the wind wheel shaft is supported, may have the said horizontal motion while transmitting the reciprocating motion to the reciprocating rods, which impart motion to a revolving shaft by two other connecting rods and cranks, both pairs of the cranks being set perpendicular to each other for passing the dead centers. The invention also comprises an arrangement of one of the said reciprocating rods within the other, and the shaft driven by them above the lower ends, to which the connecting rods are attached, and passing through a slot in each of said rods in a manner to economize space, and simplify the cost of the apparatus.

WASHING MACHINE.—Isaac H. Adams, of Montana, Iowa.—This invention relates to a new and improved washing machine, in which the essential feature is an arrangement of the rubbing boards, which is placed in the bottom of the tub, and commonly made stationary, with a joint at or about the center, and connecting the lower part with the levers for working the vibrating board, so that after the latter has been raised well off the clothes the said jointed part will be raised so as to turn and shift the clothes to facilitate the presenting all sides to the rubbing boards.

SELF-LUBRICATING JOURNAL BOX.—James Duff, Peoria, Ill.—This invention relates to a journal box placed within an oil box, and provided with a wick occupying a longitudinal groove in the side of the journal box, at the top of the same, and passing at one or more points through orifices in the journal box into the oil box, so as to take oil from the latter by capillary attraction, and deliver it at the side of the shaft in the journal box, from which it runs back into the oil box through spaces left between the ends of the latter and of the journal box, and also through spaces at the sides.

SHAFT COUPLING.—Edward G. Shortt, Carthage, N. Y.—This invention is an improvement on that for which letters patent of the United States No. 95,277, were granted to applicants on Sept. 28th, 1869, and consists in forming a transverse slot at the middle of the wedges to enable them to spring and close down upon shafts varying in size in different parts; and also in transverse grooves made in the backs of the wedges to hold tallow, and thereby prevent the wedges from rusting or adhering to the inside of the sleeve or tube.

TOY.—This is a toy constructed of spiral grooves on conical upright standards, in combination with grooved inclined planes, etc., down which marbles are rolled to a receiving block, the object being to see how many balls can be kept moving down the grooves by taking them one by one from the receiving block, and placing them in a cap at the top of the toy. Samuel Patterson, of Newark, N. J., is the inventor.

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117,716.—SEWING MACHINE.—J. S. Alter, Leavenworth, Kan.
117,717.—FOG HORN.—J. R. Anderson, Brooklyn, N. Y.
117,718.—FEEDER.—J. P. Arey, Georgetown, Colorado.
117,719.—HOOK HOLDER.—L. Arnold, Belchertown, Mass.
117,720.—BOILER.—I. Atyco, North Fairfield, Ohio.
117,721.—BUILDING.—F. M. Bain, Delaware, Ohio.
117,722.—SOAP.—G. Baker, I. Bullock, Lima, Pa.
117,723.—LADLE.—R. D. Baker, Syracuse, N. Y.
117,724.—BEDSTEAD.—T. B. Baldwin, Marshall, Texas.
117,725.—SAD IRON, ETC.—W. Banzett, Williamsburgh, N. Y.
117,726.—HARVESTER.—J. J. and D. N. Barnhill, Vincennes, Ind.
117,727.—RANGE SETTING.—A. F. Barry, New York city.
117,728.—SHOULDER BRACE.—A. W. Beaman, Boston, Mass.
117,729.—RAFTER HOOK.—J. N. Bebout, Oberlin, Ohio.
117,730.—AXLE.—J. W. and A. W. Beer, Rural Valley, Pa.
117,731.—SPRING VENT.—E. J. Bennett, Port Huron, Mich.
117,732.—DENTAL DRILL.—G. V. Black, Jacksonville, Ill.
117,733.—SHAFT COUPLING.—G. V. Black, Jacksonville, Ill.
117,734.—PLOW.—A. J. Borland, Charlestown, Iowa.
117,735.—CARPET STRETCHER.—W. Brown, New York city.
117,736.—GRAIN THRASHER.—R. Bryan, Penn Yann, N. Y.
117,737.—IRONING TABLE.—F. A. Byram, Germantown, Pa.
117,738.—STILL.—R. P. Buckland, Jr., G. A. Gessner, Fremont, O.
117,739.—CAR.—N. W., C. W. Camp, Saratoga, N. Y., N. H. Camp, Wilkesbarre, Pa.
117,740.—WASHING MACH.—W. Clack, Prairie du Chien, Wit.
117,741.—CLEANER.—C. B. Clark, Armada, Mich.
117,742.—TRACE BUCKLE.—I. Clark, Dryden, Mich.
117,743.—INKSTAND.—S. D. Clark, Minneapolis, Minn.
117,744.—TWEER.—T. S. Clark, Chicago, Ill.
117,745.—WHEEL PIT.—J. Collins, Crawfordsville, Ind.
117,746.—CUTTER.—J. W. Cornell, Lawn Ridge, Ill.
117,747.—CUT OFF.—W. B. Cross, Sacramento, Cal.
117,748.—PENCIL.—H. T. Cushman, North Bennington, Vt.
117,749.—FIRE SHIELD.—A. Dean, Ann Arbor, Mich.
117,750.—SIPHON.—E. de Lagillardaie, L'Orient, France.
117,751.—ANIMAL POKE.—N. Denny, Saranac, Mich.
117,752.—DOG.—G. E. Dowling, S. F. Cone, Montague, Mich.
117,753.—JOURNAL BOX.—I. Dripps, Altoona, Pa.
117,754.—ICE PICK.—W. T. Eames, New York city.
117,755.—HAND CARD.—G. F. Ells, Douglas, N. Y.
117,756.—COAL SHOVEL.—J. H. Farmer, Detroit, Mich.
117,757.—KINDLER.—J. E. Finley, G. H. Hurd, B. F. Tatem, Memphis, Tenn.
117,758.—CLUTCH GEARING.—L. S. Fithian, Brooklyn, N. Y.
117,759.—ROAD STEAMER.—G. W. Fitts, Oberlin, Ohio.
117,760.—TIRE.—G. W. Fitts, Oberlin, Ohio.
117,761.—DRAWING BOARD.—J. B. Franklin, New York city.
117,762.—DAMPER.—B. French, Rochester, N. Y.
117,763.—CANDLE HOLDER.—J. Fritsch, Carlstadt, N. J.
117,764.—LOCK.—C. T. Gibson, Baltimore, Md.
117,765.—CASTER.—J. Gibson, Jr., Albany, N. Y.
117,766.—SAUCER.—J. Gibson, Jr., Albany, N. Y.
117,767.—SAP SPOUT.—W. S. Gilmore, Chester, Ohio.
117,768.—LET OFF.—F. W. Graichen, Olneyville, R. I.
117,769.—SAW FRAME.—J. H. Graham, Brooklyn, N. Y.
117,770.—SOLDERING.—J. Gulding, Keyport, N. J.
117,771.—TELEGRAPH.—I. Hall, New York city.
117,772.—REMOVING SAND.—J. Halliday, New Orleans, La.
117,773.—FIRE ESCAPE.—J. C. Hancock, Charlestown, E. P. Richardson, Somerville, Mass.
117,774.—SHEARS.—C. F. Harlow, Boston, Mass.
117,775.—LOUNGE.—V. O. Hart, J. Benjamin, Naples, N. Y.
117,776.—BLOWER.—S. H. Hartman, Allegheny, Pa.
117,777.—BOOT STRETCHER.—J. Hoffman, Belvidere, N. J.
117,778.—HOIST.—J. Hoffmann, Tewksbury, N. J.
117,779.—LET OFF.—W. H. Howard, Philadelphia, Pa.
117,780.—GAME.—C. N. Hoyt, Providence, R. I.
117,781.—WATER GATE.—W. P. Hubbard, Farmland, Ind.
117,782.—WATCH.—S. Jaccard, J. J. Jaques, St. Croix, Switzerland.
117,783.—BELLOWS.—A. F. Jones, New York city.
117,784.—AUGER.—S. Katz, Bossardsville, Pa.
117,785.—PRESS.—F. Klinck, Philadelphia, Pa.
117,786.—PLUG CUTTER.—D. S. Kniffen, West Camden, N. Y
117,787.—DEFECATING, ETC.—M. Landry, Iberville, La.
117,788.—TREMOLO.—J. R. Lomas, New Haven, Conn.
117,789.—ELEVATOR.—G. B. Lowe, Jamesville, N. Y.
117,790.—SIEVE.—R. J. Mann, Burlington, Iowa.
117,791.—DIGITORIUM.—M. Marks, London, England.
117,792.—WASHING MACHINE.—T. A. Massie, Plattsburgh, Mo.
117,793.—CLINCHER.—D. Mater, Jr., Bellmore, Ind.
117,794.—COTTON PRESS.—A. McGowen, Houston, Texas.
117,795.—ENVELOPE.—C. E. McMahan, Elizabeth, N. J.
117,796.—BLEACHING.—L. Mendelson, New York city.
117,797.—SEWING MACHINE.—N. Meyers, Buffalo, N. Y.
117,798.—JOIST HOOK.—J. S. Miller, Terre Haute, Ind.
117,799.—SOCKET.—S. Mitchell, Lima, N. Y.
117,800.—BURIAL CASKET.—J. O. Moore, Albany, N. Y.
117,801.—PLOW.—S. D., D. A., J. B. Morrison, Fort Madison, Iowa.
117,802.—PAVEMENT.—D. H. Mulford, Saratoga, N. Y.
117,803.—CULTIVATOR.—A. H. Myers, Hermon, Ill.
117,804.—ICE ELEVATOR.—J. J. Neuman, Middletown, Conn.
117,805.—CARBONIC ACID.—J. D. O'Donnell, Washington, D.C.
117,806.—TRUNK LOCK.—J. H. Oliver, Baltimore, Md.
117,807.—FOUNTAIN.—J. S. Orndorff, Virginia City, Nev.
117,808.—BALANCE VALVE.—J. V. Pangburn, Galesburg, Ill.
117,809.—CRADLE.—C. O. Parker, Liverpool, Nova Scotia.
117,810.—CHAIR, ETC.—D. O. Parker, Liverpool, Nova Scotia.
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117,812.—THRASHING MACHINE.—W. H. Pratt, Chicago, Ill.
117,813.—PLOW.—R. M. Primmer, Vinton, Iowa.
117,814.—FURNACE.—H. Randall, Quincy, Ill.
117,815.—BEE HIVE.—O. P. Reeve, C. C. Parker, Central city, Mo.
117,816.—CORNER POST.—J. Roberts, Worcester, Mass.
117,817.—LIFE BOAT.—R. I. Robeson, Oskaloosa, Iowa.
117,818.—CARD ENVELOPE.—C. Rowland, Washington, D. C.
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117,820.—HEATING DRUM.—C. W. Servoss, Chicago, Ill.
117,821.—CHURN.—J. Shaver, Lawrence, Ill.
117,822.—PADDLE WHEEL.—N. P. Sheldon, San Francisco, Cal.
117,823.—SHAFT COUPLING.—E. G. Shortt, Carthage, N. Y.
117,824.—DISINTEGRATER.—C. G. C. Simpson, Montreal, Can.
117,825.—AIR ENGINE.—A. M. Smith, Chicago, Ill.
117,826.—DIE MOLD.—I. Smith, New York city.
117,827.—SAW SHARPENER.—Z. Sperry, Midland, Mich.
117,828.—TURNING LOGS.—E. H. Stearns, Erie, Pa.
117,829.—DRAFT.—J. S. Tibbets, Brazil, Ind.
117,830.—BED BOTTOM.—C. H. Triphagen, Pewamo, Mich.
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117,833.—STOVE.—H. B. Van Benthuysen, Lockhaven, Pa.
117,834.—POT COVER.—S. Van Horn, Chicopee, Mass.
117,835.—SEED PLANTER.—T. G. S. Vaniz, Canton, Miss.
117,836.—RECTIFYING SPIRITS.—W. H. Ware, Phila., Pa.
117,837.—SHUTTLE.—C. H. Waters, Groton, W. Orr, Jr., Clinton, Mass.
117,838.—DIE.—R. N. Watrous, Elmira, N. Y.
117,839.—PEG CUTTER.—W. M. Watt, Como, Miss.
117,840.—HOIST.—A. Weide, Chicago, Ill.
117,841.—AIR BRAKE.—G. Westinghouse, Jr., Pittsburgh, Pa.
117,842.—BRICK MACHINE.—W. G. White, Bedford, Ohio.
117,843.—FIRE ARM.—A. E. Whitmore, Ilion, N. Y.
117,844.—BROOM.—A. Willis, Chicago, Ill.
117,845.—OILING JOURNALS.—W. G. Winne, Albany, N. Y.
117,846.—WASHING MACHINE.—G. L. Witsil, Phila., Pa.
117,847.—CLOTHES DRYER.—M. H. Wood, Carlisle, Ohio.
117,848.—DITCHING MACHINE.—S. S. Wood, Brooklyn, N. Y.
117,849.—HUB.—J. V. Woolsey, Sandusky, Ohio.
117,850.—CUTTER HEAD.—J. V. Woolsey, Sandusky, Ohio.
117,851.—PENCIL.—C. E. Abbott, Malden, R. S. Merrill, Hyde Park, Mass.
117,852.—FIBER.—W. Adamson, F. A. Simonin, Phila., Pa.
117,853.—VALVE.—A. F. Allen, Providence, R. I.
117,854.—OIL CAN.—M. Andrew, Melbourne, Victoria.
117,855.—ROOFING.—W. S. Belt, Cincinnati, Ohio.
117,856.—BOOT SOLES.—L. R. Blake, Fort Wayne, Ind.
117,857.—TAP.—C. T. Bonsall, T. Bergner, Phila, Pa.
117,858.—TRAVELING BAG.—H. Braunhold, New York city.
117,859.—ORGAN.—R. Burdett, B. O. Church, Chicago, Ill.
117,860.—BED SPRING.—E. L. Bushnell, Poughkeepsie, N. Y
117,861.—FOG ALARM.—S. G. Cabell, Quincy, Ill.
117,862.—HARVESTER.—J. A. Cauldwell, Watkins, N. Y.
117,863.—FIRE SCREEN.—A. Chesnutwood, Davidsville, Pa.
117,864.—MOWING MACHINE.—L. S. Clark, Bethel, Conn.
117,865.—CROQUET ARCH.—F. M. Clarke, Washington, D. C.
117,866.—FAUCET.—W. Cleveland, Orange, N. J.
117,867.—HAT TIP.—J. L. Coles, Newark, N. J.
117,868.—JOURNAL.—S. P. and H. B. Cook, San Francisco, Cal.
117,869.—CANAL BOAT.—M. N. Cummiskey, Paterson, N. J.
117,870.—MEDICAL COMPOUND.—W. Curless, Truckee, Cal.
117,871.—CALL BELL.—H. A. Dierkes, New York city.
117,872.—SAFETY VALVE.—J. B. Edson, Brooklyn, N. Y.
117,873.—CONDENSER.—H. W. Faucet, Titusville, T. McGowan Meredith, Pa.
117,874.—WAGON SEAT.—J. H. Fellows, Alba, Pa.
117,875.—BRACKET.—L. W. Fifield, Worcester, Mass.
117,876.—SHOE.—F. D. Ford, New Bedford, Mass., E. D. McIntosh, Washington, D. C.
117,877.—LEATHER.—J. P. Friend, Peabody, Mass.
117,878.—HUB.—J. H. Gaines, Durhamville, Tenn.
117,879.—COFFEE MILL, ETC.—J. Garfield, Ayer, Mass.
117,880.—DIP PIPE.—W. E. Grenelle, New York city.
117,881.—LOCK NUT.—R. W. Hamilton, New York city.
117,882.—BUCKLE.—G. Havell, Newark, N. J.
117,883.—HOG RING.—D. P. Hellebower, Champaign, Ohio.

117,884.—PRESERVING FRUIT.—F.C.Hooton,West Chester,Pa.
117,885.—DRAWER.—I. A. Howe, Boston, Mass.
117,886.—KNITTING MACHINE.—J. M. Howe, Rochester, N. Y.
117,887.—STAVE.—A. J. Howell, J. Murphey, Spruce Hill, Pa.
117,888.—SHEARS.—H. H. Ingalsbe, South Hartford, G. A. Prescott, Sandy Hill, N. Y.
117,889.—MILK COMPOUND.—V. A. Jagielski, London, Eng.
117,890.—STILL.—C. B. Jarvis, J. W. Goff, Cincinnati, Ohio.
117,891.—FIRE EXTINGUISHER.—S. B. Johnson, Phila. P.
117,892.—EXTRACTOR.—T. E. Johnson, Indianapolis, Ind.
117,893.—JACK.—P. Keane, Cohoes, N. Y.
117,894.—HANGER—T. Kent, J. S. Barker, Waukegan, Ill.
117,895.—FAUCET.—W. H. Laubach, Phila. Pa.
117,896.—DRILL.—J. Lemman, Cincinnati, Ohio.
117,897.—RUBBER SHOE.—J. Letson, New Brunswick, N. J.
117,898.—CIDER MILL.—H. Lightner, Neff's Mills, Pa.
117,899.—SAFE.—L. Lillie, Elizabeth, N. J.
117,900.—FIRE EXTINGUISHER.—S. M. Lillie, Elizabeth, N. J.
117,901.—GATE.—E. Livingston, Manchester, Ill.
117,902.—CARRIAGE WHEEL.—J.H.Loughbridge,Key W.,Fla.
117,903.—GOVERNOR.—J. D. Lynde, Phila., Pa.
117,904.—DENTAL INSTRUMENT.—C. H. Mack, Portland,Oreg.
117,905.—GLUE.—J. J. Manning, Rockport, Mass.
117,906.—FIRE-ARM.—J. M. Mason, Washington, D. C.
117,907.—GAGE COCK.—P. McGrath, Plattsburgh, N. Y.
117,908.—COCK.—J. Metier Meharg, Montreal, Canada.
117,909.—COUPLING.—G. H. Merriam, Portland, Me.
117,910.—PLANTER.—C.T. Merry, M. A. Dunton, Norwalk, O.
117,911.—HARVESTER.—J. Miller, Swan, Ind.
117,912.—LOCK.—S. Miller, Gratis, Ohio.
117,913.—POTATO DIGGER.—H J. Moore, Topeka, Kan.
117,914.—BEE HIVE.—S. C. Moore, Pattonsburgh, Mo.
117,915.—CHAIR.— J.Morrison, Indianapolis, Ind.
117,916.—BUTTON, ETC.—C. A. Newton, Providence, R. I.
117,917.—HAY RAKE.—G. Notman, Deerfield, Ohio.
117,918.—STOPPER.—F. A. Ostrander, Troy, N. Y.
117,919.—LEVER PRESS.—J. Outland, Barnesville, Ohio.
117,920.—STAVE.—L. R. Palmer, Belfast, Me.
117,921.—LEATHER.—J. C. Pamerlee, Bean Blossom, Ind.
117,922.—ANIMAL POWER.—W. Patterson, Oneonta, N. Y.
117,923.—TRACE BUCKLE.—D. K. Peacock, Little Valley,N.Y.
117,924.—GRATER.—C. R. Peirce, Phila., Pa.
117,925.—GAS PUMP.—W. H. Pollard, Seneca Falls, N. Y.
117,926.—FLAX PULLER.—B. M. Reeves, Franklin, Pa.
117,927.—STUFFING BOX.—P.W. Richards, Boston, Mass.
117,928.—STUFFING BOX, ETC.—P.W. Richards, Boston,Mass.
117,929.—STEERING.—N. Richardson, Gloucester, Mass.
117,930.—COMPOUND. J. D. Richmond, Jr., N. Liberty, Ky.
117,931.—KNITTING MACHINE.—S. H. Roper, Roxbury,Mass.
117,932.—DIE.—C. E. Russ, Boston, Mass.
117,933.—RAIL.—R. S. Sanborn, Rockford, Ill.
117,934.—SPINNING RING.—J. H. Sawyer, Lowell, Mass.
117,935.—SATCHEL, ETC.—F. C. Schmidt,Newark, N. J.
117,936.—SAW MILL.—G.Selden, Erie, Pa.
117,937.—THILL COUPLING.—S. Slack, Lebanon Center, N.H.
117,938.—FLOUR BOLT.—J. C. Smith, Zanesfield, Ohio.
117,939.—PACKING.—S. Stroock, New York city.
117,940.—WASHING MACHINE.—A.T. Sullivan, San José, Cal.
117,941.—VENTILATOR.—O.W. Swift, New Haven, Conn.
117,942.—BEVERAGE.—A. S. Taylor, San Francisco, Cal.
117,943.—MOP HEAD.—L. W. Taylor, Upper Falls, Vt.
117,944.—SAW.—P. Thompson, Pittsburgh, Pa.
117,945.—ICE CREEPER.—E. M. Turner, Pittsburgh, Pa.
117,946.—PAVING, ETC.—A. B. Vandemark, Jersey City, N. J.
117,947.—TWEER.—P. L.Weimer, Lebanon, Pa.
117,948.—HOIST.—J. Wheelock, Worcester Mass.
117,949.—STEEL TOOL, ETC.—D. Wihl, Brooklyn, N. Y.
117,950.—STEEL TOOL, ETC.—D. Wihl, Brooklyn, N. Y.
117,951.—SPLITTING MACHINE.—W. L. Williams N. Y. city.
117,952.—SPLITTING WOOD.—W. L. Williams, N. Y. city.
117,953.—DIE.—J. T. Wilson, Pittsburgh, Pa.
117,954.—DIE.—J. T. Wilson, Pittsburgh, Pa.
117,955.—HEEL.—C. Lambert, Quincy, Mass,
117,956.—BARREL PITCHER. A.D.Witzleben,Washington,D.C.

REISSUES.

4,501.—FIRE PLATE.—E. Boileau, St. Louis, Mo.—Patent No. 92,253,dated July 6, 1869.
4,502.—JOURNAL BOX.— J. Duff, Peoria, Ill.—Patent No. 90,937, June 8, 1869.
4,503.—Division A.—CLOTHES FRAME.—J. E. Earle, New Haven, Conn.—Patent No. 86,994, dated November 25, 1862.
4,504.—Division B.—CLOTHES FRAME.—J. E. Earle, New Haven, Conn.—Patent No. 86,994, dated November 25, 1862.
4,505.—CLOTHES RACK.—V. M. Heath, Morristown, Vt.—Patent No. 94,598, dated September 7, 1869.
4,506.—IRON SPOON.—G. I. Mix, Yalesville, Conn.—Patent No. 18,518, dated October 27, 1857.
4,507.—IRON AND STEEL.—A. H. Siegfried, South Bend, Ind.—Patent No. 113,583, deated April 11, 1871.
4,508.—EXTRACTING FAT.—C. F. A. Simonin, Phila., Pa., and E. W. Coffin, Glendale, N. J.—Patent No. 102,166, dated April 19, 1870; reissue No. 4,067, dated July 12, 1870.
4,509.—Division A.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.—Patent No. 80,774, dated August 4, 1868.
4,510.—Division B.—LOOM HARNESS.—J. Sladdin, Lawrence, Mass.—Patent No. 80,774, dated August 4, 1868.
4,511.—GRATE BAR.—J. R. Smith, Salem, Mass.—Patent No. 70,638, dated November 5, 1867.

DESIGNS.

5,164 to 5,174.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,175.—CARPET PATTERN.—A. Cowell, Kidderminster, Eng.
5,176.—MOLDING.—J. H. Ferreira, Newark, N. J.
5,177 & 5,178.—STAIR RODS.—W. B. Gould, New York city.
5,179 to 5,182.—OIL CLOTHS.—Henry Kagy, Philadelphia, Pa.
5,183.—SHARPENER.—C. Kennedy, Philadelphia, Pa.
5,184.—CARPET PATTERN.—W. Kerr, Phila., Pa.
5,185.—DRAWER PULL.—J. Kintz, West Meriden, Conn.
5,186.—TILE.—B. Kreischer, New York city.
5,187.—CARPET PATTERN.—C. S. Lilley, Lowell, Mass.
5,188 & 5,189.—CARPET.—J. Nell, Clinton, Mass.
5,190.—CAKE DISH.—W. Parkin, Taunton, Mass.
5,191.—HARNESS SADDLE.—L. Rommeiks, Newark, N. J.
5,192.—DRAWER PULL.—J. B. Sargent, New Haven, Conn.
5,193.—CARRIAGE BODY.—R. M. Stivers, New York city.
5,194.—DENTIST'S TRAY.—E. T. Starr, Phila., P.
5,195.—CALL BELL.—H. C. Wilcox, West Meriden, Conn.
5,196.—TEA BELL.—H. C. Wilcox, West Meriden, Conn.

TRADE MARKS.

416.—MEDICINE.—P. Davis & Son, Providence, R. I.
417.—MEDICINE.—J. N. Harris & Co., Cincinnati, Ohio.
418.—SHIRTING.—B. B. & R. Knight, Providence, R. I.
419.—JEWELRY, ETC.—S. Landsberg, New York City.
420.—FABRICS.— San Francisco Pioneer Woolen Factory, San Francisco, Cal.
421.—MEDICINE.—Tilden & Co., New Lebanon, N. Y.

EXTENSIONS.

BOBBINS. I.HAYDEN, of Boston,Mass.Letters Patent No.17,929, dated August 4, 1857.
SULPHURIC ACID. A. MONNIER, of Philadelphia, Pa.—Letters Patent No. 17,976, dated August 11, 1857; reissue No. 592, dated October 6, 1857; reissue No. 602, dated September 21, 1858.

Inventions Patented in England by Americans.

July 18 to July 24, 1871, inclusive.
(Compiled from the Commissioners of Patents' Journal.

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CHAIR.—W. Palmer, New York city.
CUTTING ENVELOPES, ETC.—H. A. Clark, Boston, Mass.
HASP.—W. H. Tison, Savannah, Ga.
LOOM.—J. Kuttner, New York city.
STEAM PLOW.—J. Lochhead, C. A. Mathieu, San Francisco,Cal.
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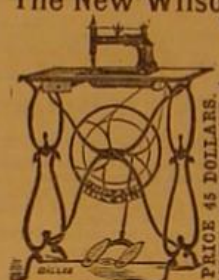

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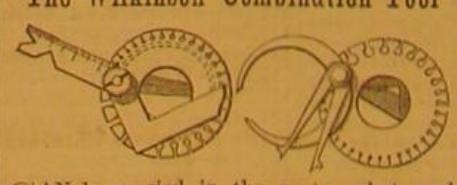

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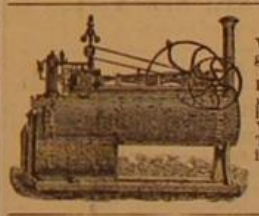

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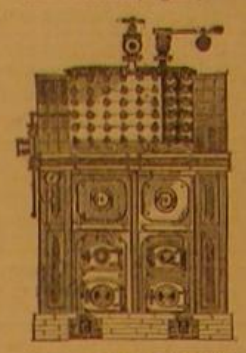

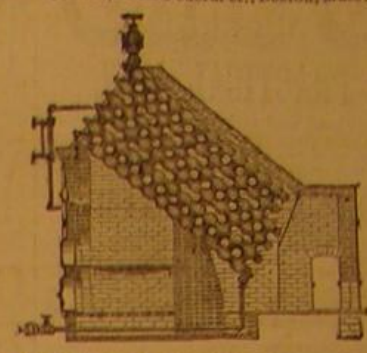

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