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A MEW METHOD OF STEAMBOAT PROPULSION.

Mr. Eli Hunt, of Nyack, N. Y., a gentleman of long experience in steamboat management and construction, has invented a novel means of propulsion for such vessels, the nature of which will readily be understood from the annexed engraving. Mr. Hunt is of opinion that a boat, of the dimensions below given, can, with two of his wheels, be driven at the rate of thirty miles per hour; and he further considers that, by means of the general arrangement of the device, increased steadiness of the vessel will be obtained.

The boat taken as an example is to be 250 feet long, of 40 feet beam at a distance of 100 feet from stern, 32 feet wide at stern, of 10 feet depth of hold, and of 4 feet draught. Propulsion is obtained by two screw wheels 15 feet in diameter and of 22 feet pitch, with straight blades placed to dip within one foot of the bottom of the boat, and arranged as shown in the illustration. These screws travel in opposite directions; and as their vanes are long and elastic, it is believed that, despite their size, they will jar the vessel much less than the ordinary submerged screw. The inventor proposes to drive his propellers at 150 revolutions, which, he claims, with a pitch of 22 feet, would secure a speed of 37½ miles per hour; 7½ miles are deducted for slip, leaving 30 miles per hour as the effective speed of the boat.

Mr. Hunt sends us no records of practical tests of his invention; but he considers that, judging from his experience, it is entirely practicable, and possesses advantages both over the paddle wheel and ordinary propeller. It allows of stern screw propulsion in very shallow water; and if the speed mentioned is realized, it might be applied in lieu of the paddle wheel upon steamboats on our Western rivers.

Manufacture of Iron and Steel.

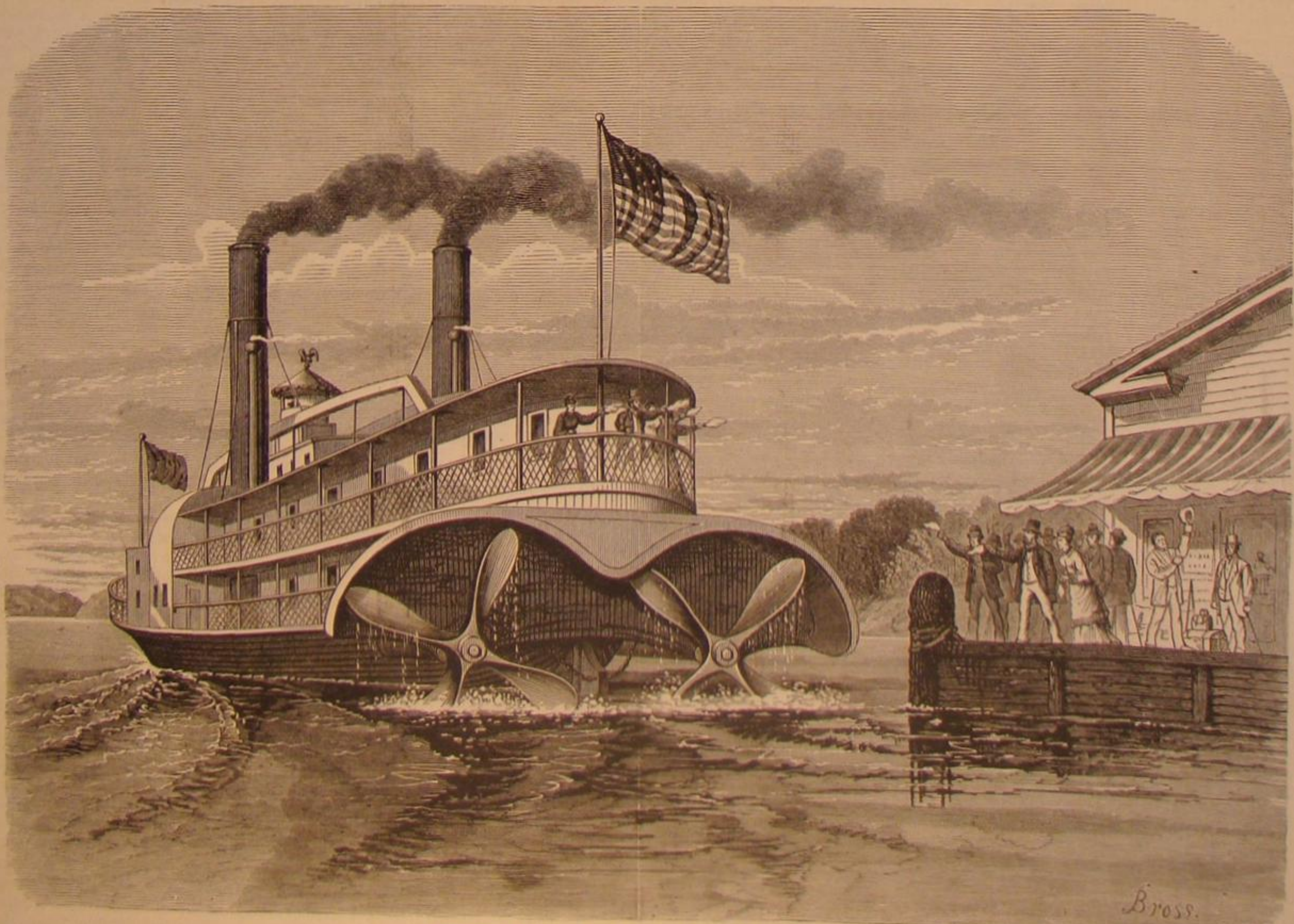
Cast iron containing carbon and other substances, such as manganese, silicon, or other alloy, is now added to fluid iron and steel, by which carbon is added to them. The amount of carbon in cast iron being limited, a large proportion of cast iron must be added, if much addition of carbon be required, whereby other substances contained in the cast iron are necessarily added. The improvement in this respect proposed by J. G. Willans, of Westbourne Park, London, England, is to carbonize cast iron or steel granules or particles by mixing them up with a hydrocarbonaceous substance (such as pitch, tar, oil, farinaceous or bituminous substance, and suchlike), and to heat the mixture to about a red heat in a retort, vessel, or chamber, without access of air. The metal granules will thus be coated with adhering carbon; he adds these carbonized granules to the fluid iron or steel (sometimes by means of blast or other gaseous current). The quantity of carbon absorbed into the fluid iron or steel will thus be greater than if the original cast iron alone was added. If it be desired to add or apply deoxidized iron ore, or other metals or substances to the fluid iron or steel, he applies the material or substance containing it coated with carbon as he does granulated iron.

Cast irons containing much silicon or phosphorus are at present unsuitable for the production of superior wrought iron and castings. The same pig iron, if properly refined in the ordinary coke refinery or by other means, will lose the greater portion of its silicon; and if similar or other pig iron be converted into wrought iron by the usual process, the greater portion of its phosphorus as well as silicon will be removed. Mr. Willans proposes to melt down in a cupola furnace a mixture of refined cast iron and of wrought iron. The amount of silicon and phosphorus in the resulting metal may thus be proportioned to equal the average of these substances in cold blast all-mine pig irons; and owing to the contact of the wrought iron with the coke or other fuel, the metal will contain sufficient carbon to fit it for use in the foundry or puddling furnace.

Hitherto the reduction of iron ores or oxides to a metallic condition without melting them has been effected by mixing carbonaceous matter therewith, and heating them in close vessels, or by having the ore or oxide in a retort heated externally, and into which a reducing gas was admitted. It has also been suggested to heat the interior of the retort or chamber in which the ore is placed by the combustion of part of the gas, leaving the remainder in a highly heated condition, but adulterated with a watery vapor or carbonic acid to act upon the ore. Mr. Willans' improvement is to bring a reducing gas, such as carbonic oxide or hydrogen, or compounds of hydrogen and carbon, or their mixtures, up to the necessary temperature at which the iron ore or oxide becomes acted upon before it be admitted into contact with them without any such admixture of air as would support combustion, so that the vessel containing the ore or oxide be not necessarily heated, either externally by fuel, or internally by the partial combustion of the gas; or he has the ore or oxide sufficiently heated before it be put into the place where the reducing gas at less temperature in an unignited state be admitted. He prefers to pass the gas through a heater (such as is now used for heating the blast furnaces will answer), so that it be heated sufficiently to deprive any iron ore brought into contact of its oxygen.

In order to facilitate the more uniform action of reducing gas on iron ore or oxide, he employs a rotating (preferably inclined) cylinder or vessel, into which ore or oxide is placed; he has a gas pipe with sufficient opening for the exit of the gas inserted into the cylinder, and around which the cylinder and its contents (however heated) revolve. The position of the ore particles are thus continually changed, and the gas brought more equally amongst them. When the ore or oxide be sufficiently deprived of its oxygen, it may be transferred from the cylinder into vessels to cool without access of air, for after use as iron in a divisional state in the manufacture of iron and steel, or for other purposes; or it may be transferred whilst still hot into chambers or vessels to be welded or melted into malleable iron or steel; he sometimes adds carbon or finely granulated cast iron to the reduced ore or oxide before welding or melting it.

A VERY fine shaving soap solution may be made by taking ¼ lb. white Castile soap in shavings, 1 pint rectified spirit, ¼ pint water; perfume to taste. Put in a bottle, cork tightly, set in warm water for a short time, and agitate occasionally till solution is complete. Let stand, pour the liquid off the dregs, and bottle for use.



HUNT'S SYSTEM OF SCREW PROPELLERS.

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THE NATURE OF PAIN.

As one of the chief determining factors in the struggle for sentient existence, pain impresses itself upon our attention almost momently. The ideal perfect life that men imagine is always one in which pain forms no part: yet curiously, in all the life we know, pain is ever the penalty paid for superiority. The higher the organism in the scale of being, the greater its capacity for pain: this is the universal rule. Mutilation, such as an insect bears without apparent inconvenience, will kill a reptile. A fish or a reptile disregards injuries that would be quickly fatal to a mammal through nervous shock. A savage laughs at wounds that would rack the nervous system of a civilized man with acutest agony. Thus in every instance capacity for pain is the measure of development.

The question: What is pain? consequently assumes the highest speculative interest and importance: while the determination of its physical conditions and causes ranks second to no other scientific problem in practical significance. Nothing else promises so much for the alleviation of human suffering, to say the least: and the discovery of no other secret of Nature appeals more strongly to the feeling of average humanity.

Common experience tells us that pain has its source in the physical system. The gulf between nervous movement and sensation is as unthinkable as the gulf between brain movement and thought: yet no one presumes to say that pain is other than the product of material conditions, however obscure those conditions may be; or that pain can be imagined as existing apart from organization.

In his prize essay on therapeutic means for the relief of pain, Dr. Spender makes the strange assertion that "we look for the cause of pain in dead nerves and dead nerve centers; and if we miss the expected result to-day, we do not doubt that it will be found hereafter with more perfect instruments of scrutiny."

Seeing that pain is ever an adjunct of life, and that death and insensibility always go together, the cause of pain must rather lie in some disturbance in living nerve or nerve center; and such is the view of most of the more recent investigators in this field. Even the learned writer just quoted subsequently abandons, albeit unwittingly, the position he had taken, when he assumes "as a positive truth, that pain connects a molecular disturbance in the nerve which carries the idea of pain to the sensorial center;" for surely a nerve which performs in that way its normal function cannot be justly described as dead.

Long ago, Romberg described pain as the prayer of a nerve for healthy blood. The definition is true as far as it goes, but it stops short of the whole truth. Pain is also the protest of a severed, bruised, or poisoned nerve; and not unfrequently an excess of healthy blood in the part traversed by a nerve will result in pain. Indeed, Dr. Chapman has gone so far as to erect a theory of pain on this basis alone, and a method of treatment also.

On the other hand, Drs. Anstie, Ratcliffe, and others hold that pain is usually, if not always, associated with an opposite condition, with deficiency of blood, and impaired nutrition. Dr. Anstie, in his classic work on neuralgia, shows that those neuralgias are most acutely agonizing which occur under circumstances of impaired nutrition incident to the period of bodily decay; and that there are strong reasons for the belief that there is especial impairment of the nutrition of the central end of the painful nerves. From this point of view, pain involves a depreciation of true function. It is due to a perturbation of nerve force; and the susceptibility to this perturbation is in proportion to the imperfection of the nerve tissue, until the destruction of nerve tissue cuts off communication and ends in insensibility.

The perturbation of nerve force, however, does not always result in pain; it may show itself in the motor or the intellectual department as well. When nerve degenerates, the first result is shown in the sensory department, as pain; in the motor, as spasms; in the intellectual, as delirium; and the final results of nerve destruction are shown respectively in numbness, paralysis, and coma. Thus the pain of nerve, the spasm of muscle, and the delirium of brain are described as correlative phenomena; and a similar parallel is held to exist between the numbness of nerve, the paralysis of muscle, and the coma of brain. And these phenomena are often interchangeable, the members of the two series being subjectively identical, though outwardly very different.

Evolution being attended by an ever-increasing complexity and delicacy of nervous organization, it is inevitable that increasing liability to nervous derangement must mark every upward movement in the scale of being. Will the price of elevation ever rise so high as to put an end to progress in this direction? There would certainly seem to be a possibility of such a result, when we consider the fate of those most admirable persons who are, as we say, too finely strung for this rude world. The acuteness and delicacy of their sensibilities make them at once the highest moral and intellectual types of humanity, and physically the most unfortunate. And they rarely or never leave behind them a vigorous family.

Regarded as an independent evil, pain is one of the deepest of life's mysteries; as a necessary condition of sensibility—the mainspring of intelligence—it is no mystery, but an inevitable reality, and therefore, where not to be prevented, bearable. It is only preventable evils that are intolerable.

Religion has pronounced all pain to be the penitential heritage of a sinful world—a dictum as false as it is foolish: false because pain existed long before sin was possible, and remains with innumerable forms of life which can have no share in sin; and foolish because it discourages the avoidance or mitigation of pain.

Philosophy has done better in finding pain to be a severe but beneficial schoolmaster. But there are pains which do not teach, as for example the pains of parturition, which are purely physiological; while other unavoidable pains speedily bring the sufferer to a state in which learning is impossible, yet convey no instruction to the looker-on.

Another view of pain finds it the grand preserver of existence, the sleepless sentinel that watches over our safety and makes us guard against both present injury and present pleasure that may bring injury in its train. Pain does have this function sometimes, but too often it does nothing of the sort, and can do nothing, since it comes *from* conditions over which we have not and cannot have any control.

In short, though it may be all three, pain is not in itself a punishment; it is not a schoolmaster; it is not a sentinel; it is not an unfathomable mystery. It is simply an inseparable condition of sentient existence. It does not always destroy, because in the main, with such types of life as have escaped extinction, capacity for enduring pain has not fallen short of capacity for pain; while the average environment of life has never been absolutely incompatible with some type or types of existence. Some time or other it probably will become so on earth, as it already has on the moon: then life and pain will go out together.

SCIENTIFIC SIGHT-SEEING.

Anybody of good character and over 16 years of age, with $5,000 and two years' time at his disposal, can now go around the world. Mr. James O. Woodruff, Director, and Mr. Daniel Macauley, Secretary, have organized a "scientific" expedition, which is to depart from New York on October 1st next, and to proceed to South America, Pacific Islands, Australia, Japan, China, India, and Europe, traveling a distance of some 50,000 miles—funds payable in advance before the ship sails. As a special inducement, the prospectus of the project says that the vessel will be navigated by officers of the United States Navy, six in all, whose names are given below. A faculty of scientific instructors has been engaged, also "a competent corps of attentive waiters, who will not be permitted to solicit or accept any fee or gratuity whatever." Naval cadets will be taken at half price, and are to be drilled by the officers aforesaid, and to be treated as if on a naval academy practice cruise; but as there is a probability that a class of scientific maidens will likewise be aboard, a disturbing element will, we fear, be introduced, such as does not obtrude itself among the midshipmen when at sea.

The naval officers referred to are Commander J. W. Philip, Lieutenant Commander A. S. Crowninshield, Lieutenants C. T. Hutchins, W. W. Rhoades, and F. A. Miller, and Surgeon J. H. Kidder. On looking over the numerous testimonials appended to the prospectus, we find the scheme to be commended by the following eminent gentlemen: Governor J. D. Williams, and Secretary of State J. E. Neff, of Ohio; Professors Joseph Henry, J. S. Newberry, Asa Gray, James D. Dana, D. C. Eaton, A. E. Verrill, and George J. Brush: Presidents Porter of Yale, Anderson of Rochester University, Angell of Michigan University, Indiana State Geologist Cox, and Acting President Russell of Cornell University. In view of the fact that the names of the naval officers above noted are prominently referred to, both in order to create confidence in the safe navigation of the vessel, and as constituting a part of the scientific faculty, we recently addressed a letter to the Secretary of the Navy, with a view of verifying the statement of the prospectus that "some of these officers have not yet been detached for the purposes of the expedition, but all have been conditionally engaged and will undoubtedly accompany it." In reply, the Secretary informs us that his department has no knowledge of this expedition, except that gained "through your (our) letter, and at the same time the receipt of a pamphlet giving its details." The assertion, then, that the aforesaid naval officers are going, and the promises and assurances based thereon, appear to be untrue and unfounded. The doubt thus cast over the whole scheme leads us to think that the college professors and other eminent gentlemen above named, who have lent it their indorsement, have been imposed upon.

CROUP DUE TO MIASMA.

Dr. Lewis S. Pilcher has recently made a valuable report to the Kings County (N. Y.) Medical Society on the subject of croup. Dr. Pilcher has studied that disease with much care with reference to local conditions. A map of Brooklyn accompanies the report, on which the dwellings wherein cases of the disease have been met with are suitably indicated. It needs but a glance at the map to perceive just where the malady has been most prevalent, and to enable deduction as to the probable influence of the soil, drainage, etc., on its persistence to be readily made.

Under the term "croup," the author includes "all forms of acute inflammatory affections of the larynx or trachea which may produce narrowing of their caliber to such an extent as to occasion serious prolonged dyspnœa." This embraces three conditions, namely, catarrhal croup, membranous croup, and diphtheritic croup. The first two differ in the secretion, in the former case being liquid, and in the latter its giving rise to a false membrane of varying thickness. Diphtheritic croup differs only from membranous croup in being recognized as a part of a general diphtheritic infection.

Exposure to cold produces catarrhal croup; but membranous croup demands for its production not only cold and moisture but also a miasmatic poison, the character of which is allied to that which is active in diphtheria.

The conditions under which the author has found that the worst forms of croup may be generated are abundantly prevalent in some parts of Brooklyn. The disease runs riot among the large numbers of badly nourished and weakly children in the thickly populated tenement house districts; and wherever examination has been made into the physical nature of the soil, in localities where croup has been most frequent, there unfavorable conditions have been encountered. Along the water front, occupying ground rescued from the river or bay; upon the site of marshes, now more or less obscured by the filling-in process; in valleys that have been the site of watercourses, whose drainage is imperfect; these are the districts over which, as the map plainly shows, the malady has destroyed the most people.

Croup is not commonly encountered among the list of diseases which Science has thus far traced to miasmatic causes. Dr. Pilcher's conclusions are therefore of especial value in calling attention to the fact that so prevalent a malady is preventable by the ordinary sanitary precaution of proper drainage.

THE TORPEDO DEFENCE PROBLEM.

Some of our contemporaries, in discussing the question of torpedo defence, which certainly is the ruling one of the hour in relation to naval warfare, apparently consider that the offensive powers of torpedo boats have been overrated, and that, to whatever type these craft may belong, so long as they are not submarine, the modern ironclad has ample resources to protect herself against them. These resources include, first, speed; secondly, the electric light; thirdly, heavy long range artillery; and fourthly, torpedo nettings. It is urged that an ironclad capable of steaming 16½ knots, the Alexandra, for instance, can easily run away from such a craft as Admiral Porter's Alarm, whose speed is much less; that by two electric lights, kept in revolution and so constantly illuminating the horizon, the approach of a torpedo vessel at night would instantly be noticed; that one well aimed shot from an 81 or 100 ton gun would infallibly send the aggressive boat to the bottom; and that, even did the latter manage to reach the ship, the torpedo netting (see our engraving of the Thunderer on another page) would prove a troublesome obstacle. It is scarcely the province of this journal to discuss naval tactics or the art of war; but the investigation of this problem of an efficient system of torpedo defence involves the consideration likewise of all circumstances of torpedo offence. As in any other scientific investigation, it is absolutely necessary that all conditions having any bearing on the subject be carefully gathered and weighed, otherwise accurate results are impossible. Theoretically, the objections above summarized appear forcible: practically, that is, viewing all circumstances under which torpedo attack might be made, they do not. It must be admitted that defences inadequate under any conditions do not answer the requirements of the problem; and that there are conditions under which each one of the above-named means of protection fails, a little consideration will render evident. First, as to speed. While it is reasonably certain that, running a straight course, the torpedo vessel making twelve could not catch the ironclad making sixteen knots, account must be taken first of the delay in developing that speed in the larger vessel, and the difficulty in manœuvring her, as compared to the facility with which the torpedo boat can be handled. It is safe to estimate that at least fifteen minutes will be occupied in getting an 8,000 ton ironclad under swift headway, supposing her to be under low steam, keeping her position off a blockaded harbor. This would afford a torpedo boat abundant time to overtake her. The electric light is of little avail in fogs. In the dense mists prevalent on the Northern Atlantic, there is no mode of illumination which would reveal an enemy until too late for effective resistance. Thick weather, moreover, would necessitate the vessel keeping under slow headway, another advantage for the attacking craft. As regards the use of heavy guns against an approaching vessel, it is easier to talk of hitting such a target than to do it, even in the full glare of the electric light. A small Thorneycroft launch, for example, would be in some measure screened by the waves in an ordinary sea way; it is reasonable to believe that at night such a vessel might easily approach within a quarter of a mile of her enemy before being revealed by the passing beam of the electric lamp. As she would be under full headway of at least twelve knots per hour, this interval could be traversed in a minute and a quarter. In that period, we do not believe it possible to train and sight a heavy gun and fire so as to hit a craft coming bows on, and thus presenting a minimum and rapidly moving surface at which to aim. Torpedo nettings may be reached over by a boom of proper length on the attacking boat; or if the latter is of the Alarm type, there probably would be little difficulty in breaking through them. It is of course most likely that torpedo vessels will attack only under circumstances which give them an advantage: that it is to say, they will await foggy and stormy weather: or when, as in the case of a bombardment, immediate action is necessary, several launches at once might attack a single ironclad with every prospect of at least one torpedo accomplishing its object. The recent sinking of a Turkish monitor by a torpedo, attached to her and exploded by the electric current, the work being done by sheer audacity on the part of the aggressive party, indicates how great the advantages normally are on the side of the torpedo.

In previous articles, we have noted the nature of the attack of the submerged torpedo, against which the general means of defence must also be a safeguard. Above we have endeavored to point out sundry especial sources of weakness in the present mode of protection. Other conditions affecting the problem will probably develop themselves on closer study. Meanwhile we especially commend the investigation to American inventors, as we think they can produce something better than the crinoline for ironclads which just now is the extreme outcome of English ingenuity in this line.

St. John, N. B., Burned.

St. John, the commercial metropolis of New Brunswick, was recently visited by a conflagration which destroyed the entire business section of the city, extending over an area of some 200 acres. But one building was left standing in the portion covering some forty blocks south of King street. How the fire originated is not known; but it appears to have broken out among some wooden buildings, and, fanned by a gale, to have spread with a rapidity which defied all efforts to prevent it. Shipping and wharves served as additional fuel; and then, making their way into denser parts of the city, the flames destroyed churches, hotels, public buildings, and all the prominent stores. The value of the property burned is estimated at $10,000,000. Several persons were killed, and thousands of people have lost everything.

St. John possessed a presumably adequate water supply, the works having a daily capacity of 5,500,000 gallons. The fire department was well disciplined, and it was supposed that the safeguards against a large fire were sufficient. The calamity, however, only goes to prove that wherever highly inflammable wooden structures are allowed to exist in a city danger is always imminent. The best drilled fire organization is not a match for the intensely hot blaze of well dried wood. When laws become general forbidding the existence of any but fireproof buildings in cities, then immunity from great fires will be reasonably secure; but until then, even the best organized fire service can only be regarded as partial protection.

The India Rubber Supply.

The native way of supplying the trade with rubber is highly wasteful, and if no preventative means were taken it would not be many years before the supply would fall far short of the demand, which is increasing at an enormous rate; in fact, the world cannot get along without rubber, which has now become one of the most necessary materials in a variety of trades. It has been the improvident practice to cut down trees 150 or 200 feet high, to secure one hundredweight of rubber, and thus the forests of rubber trees, especially in Brazil, are being destroyed, and will ultimately belong to the past. Without waiting for such an event, the British Government has shipped 2,000 Brazilian rubber plates to the Island of Ceylon, and, strange to say, in the incredibly short space of two months after the seeds had been sown, the little trees produced the finest kind of rubber—equal to the best of Brazil. In June, 1876, 90,000 seeds were received, of which, however, only 2,500 were alive; as their vitality is very short, they were sown at once, covering a space of 300 square feet. A number began to grow, and in a few days many of them were eighteen inches high. Cases were then made containing fifty plants each, large enough to allow for growth during transit on shipboard. They were sent to Ceylon, Singapore, Burmah, and other places, and the 2,500 plants thus distributed will do a great deal of good in preventing the otherwise impending calamity of a scarcity of rubber.

Earthquake Waves.

At a recent meeting of the California Academy of Sciences, the President, Professor George Davidson, of United States Coast Survey, exhibited an enlarged drawing of the regular tidal waves, and of the recent earthquake waves that reached San Francisco Bay on the 10th of May, 1877, and supposed to have been occasioned by the terrible earthquake that destroyed the town of Iquique, Peru, on that day.

At Fort Point the United States Coast Survey maintains a self-registering tide gauge whereby a sheet of paper is drawn horizontally over rollers that are moved by clockwork. The forward movement is nearly two feet in 24 hours. Over this sheet of paper a pencil moves athwartships by the lowering or rising of the float in the float box, and the wheel work is so proportioned that one foot movement of the tide exhibits itself as a movement of one inch of the pencil. The drawing at the Academy was four times the length and breadth of the tidal sheet. On the sheet there is an apparent irregular ebbing of the tidal waters for a few minutes, and then a sudden rise, followed by a depression, until six large waves, of about nine inches each, had exhibited themselves in the space of one hour and 20 minutes. The earthquake waves continued to nearly noon of May 15th, when the last one registered itself; but long before this it was evident, from the irregularity of time, elevation, and form, that these were reflex waves reaching from far-off limits in the ocean. In fact, it seems likely that the reflex waves commenced certainly not later than the 30th, and possibly before that.

"So far as we have been able to ascertain," says Professor Davidson, "the earthquake at Iquique occurred on the 10th of May, at 1 o'clock, A.M., but we must await more definite information before endeavoring to decipher the readings of the tidal register. Assuming, however, that the earthquake occurred at 1 A.M., we know that the difference of longitude from San Francisco is 3 hours and 28 minutes, and that the first indication of the incoming wave occurred at 6 hours and 18 minutes at San Francisco. This would give 8 hours and 46 minutes for the time occupied in the wave traversing 5,200 statute miles, mainly along the shores of South and North America, at a rate of 600 miles per hour, or 10 miles per minute.

"This is much greater than the progress of the earthquake wave that left Simoda, Japan, on the 23d of December, 1854, and reached San Francisco in about 12 hours, traveling at the rate of 375 miles per hour, or 6·2 miles per minute. But the great waves of that earthquake were only eight inches in height and 35 minutes apart when they reached Fort Point. In the present case the main principal waves were much higher, and their crests much further apart.

"Further information may place the *locus* of the earthquake away from Iquique. Upon this coast we ascertain that the earthquake wave was not noticed at open ports or landings, such as Santa Barbara, Gaviota, etc.; but its effects were exhibited in such harbors as Wilmington, Cayugas, and doubtless would have been especially noticed at the mouth of the Estero Limantour, in Drake's Bay. In these harbors the rapidly advancing and rising wave would be concentrated as into a funnel and rise and fall rapidly and largely. It is reported that the rise and fall was 7 feet at Wilmington, not noticed at Santa Barbara and Gaviota, and 12 feet at Cayugas. The reported shock to two vessels near the entrance to San Francisco harbor seems somewhat problematical. The waves entered the Golden Gate about 1 foot high and about 10 minutes long. We were at Fort Point at the time, and, with a smooth sea, could detect no change of rise and fall on the beach, where a very slight surf was running."

News of the earthquake waves coming in was telegraphed to Washington a few hours after they commenced, and from their length and height it was predicted that a great earthquake had occurred at a distant place.

Porotype.

Porotype is, we learn from the *Photographisches Archiv*, a newly devised process for copying copper-plate engravings, woodcuts, and other designs of a like nature. It is based on the principle that porous paper which has been printed upon by fatty ink loses, wherever ink attaches, its porous character. An engraving upon paper is only porous when there is no ink, and will neither allow gas nor liquid to penetrate wherever the black ink appears. A gas which acts upon a certain chemical agent, and either bleaches or discolors it, is permitted to penetrate a copper-plate engraving or woodcut where possible, and, coming into contact as it permeates with paper which has been suitably prepared, brings about a reaction—that is to say, wherever the gas has found means to penetrate, the color of the prepared paper alters, and a copy of the engraving is in this way produced.

In the process, therefore, four papers are necessary; one, which is capable of generating gas, and which is soaked with hyposulphite of soda; a second, or sensitive paper, which is, in fact, paper treated, first of all, with extract of nut-galls, and afterwards with sulphate of iron solution (ink paper); thirdly, filter paper; and fourthly, oiled paper. The copying of the engraving may be effected in the leaves of a book under pressure. The engraving is put upon the sensitive paper, and upon the engraving is laid the generating paper. Over these is laid a sheet of filter paper which has been previously impregnated in dilute sulphuric acid; then a sheet of plain filter paper; and lastly, the oiled paper. The whole is pressed together for ten minutes, when the copy ought to be finished. A report upon the process by Professor Böttger is not very favorable to it.

A Vindication of Justice.

Eleven men recently suffered the death penalty in Pennsylvania, in expiation of murders committed by direction of a lawless gang which for several years has, in certain parts of the State, rendered life and property insecure. The conspiracy bore the outward semblance of a trade society among the miners, and its victims were those who in some manner had interfered with their attempts to override the rights of other people. Murders by order of similar leagues have not been unknown in England; but in this country the worst outrages committed during trade uprisings have rarely extended beyond ordinary assaults. The "Molly Maguires" have now, it is to be hoped, discovered that the law alone arrogates to itself the right to destroy human life.

Huber's Test for Free Mineral Acids.

This new agent consists of a mixture of solutions of molybdate of ammonia and ferrocyanide of potassium. When this clear yellowish solution is added to a colorless aqueous solution, which contains, besides salts of alkalies and alkaline earths, a trace of free mineral acid, such as sulphuric, hydrochloric, nitric, phosphoric, arsenic, sulphurous, or phosphorous acid, there appears at once a reddish yellow color or turbidity, and with more acid a dark brown color, which disappears again upon adding the slightest excess of alkali. Boracic and arsenious acids, however, do not give any reaction with this test. It has been suggested that this Huber reagent may be employed, instead of litmus or cochineal, as indicated in acidimetry and alkalimetry, to determine sharply the neutral point.

A NEW SYSTEM OF PETROLEUM STORAGE.

Fires in petroleum tanks are accidents of common occurrence, and the loss therefrom yearly aggregates heavy sums. Leakage and evaporation are other sources of waste, which aid in reducing the profits gained between producer and consumer, or which, in other words, tend to increase the price which the latter pays for the commodity. It has been evident for some time that some better system of storage than that of keeping the oil in huge tanks is required; and this need M. Donny aims to supply in the improved system which we illustrate herewith. The oil may be stored either in bulk or in barrels, without, it is claimed, being subject to loss by evaporation or leakage, while it is thoroughly protected against the danger of fire.

M. Donny's project comprises two distinct parts. One is destined to receive petroleum directly from the pipes or from vessels in bulk; the other, to afford proper receptacles after the oil is in casks. The system of bulk storage is represented in plan and in horizontal section on the lower part, left side, of Fig. 1: and Figs. 4 and 6 respectively show the longitudinal and transverse sections of the reservoirs, *i*, on the lines, K L and E F. It is proposed to employ cement cisterns, vaulted and covered with earth. These may be constructed either above or below the surface. If made in earth naturally damp, they will preserve the oil and remain perfectly staunch; but if built on the surface, in order to prevent leakage it will be necessary to keep the masonry constantly moist. To this end in the outer walls a series of channels designed to receive water are made. The oil taken from the ship by means of the pump, *o*, is received in a small collecting reservoir, *n*, whence it is directed by metallic canals, *m*, with the different cisterns. In order to remove the petroleum from these receptacles, if the latter are under ground, pumps are used; if above ground, simple draw-off cocks, *k*, *l*, are all that are required.

The storage arrangements for petroleum in barrels are represented in plan in the upper part of Fig. 1. Figs. 2 and 3 show longitudinal and transverse sections on the lines, A B and C D, in Fig. 1, and Figs. 5, 7, 8, 9, and 10 exhibit the principal details of the system. The magazines, *d*, are of masonry, arched and covered with earth. They are long, but quite narrow, resembling tunnels, and are closed by a double system of doors which will be described further on. The floor is formed of two inclined planes extending in the direction of the axis of the magazine to a trench, *e*, which extends the entire length. To the right of the doors is a sidewalk, 8 inches high, so that the bottom of the magazine becomes a kind of vat, emptying into the trench which, by the subterranean conduit, *u*, communicates with a large cistern, *g*. The doors are represented in elevation in Fig. 7 and in section in Fig. 8. Each door is double; the first is of light sheet iron and adjoins the masonry; the second, of the same material, moves in a large groove in the masonry, and automatically replaces the first door when the same is lifted. The cistern, *g*, may be emptied by fixed pumps; and it communicates with the air by chimneys, *h*, in which are wire gauze screens or thick layers of gravel. Figs. 9 and 10 show the details of construction of the air seal; *a*, Fig. 1, is the entrance to the building; at *b* are offices, etc.; *c* is the courtyard; *p* the discharging point; at *q* are cranes; *r* is a railway; and *s* is a turntable.

M. Donny thinks that this arrangement reduces danger by fire to a minimum. At the moment of conflagration, two cases may occur. The atmosphere of the magazine may be charged with inflammable vapors. In such case an explosion will first take place, which will blow out the two light doors which close the entrances of the magazine, and the fire will rapidly attack the barrels. But as soon as the first doors are blown away, the second doors fall down in their places; and thus, the air supply being cut off, the fire is smothered. Should no explosion take place, then the first set of doors will be uninjured and will cut off the air. Should the doors, however, be out of order, then the oil on its receptacles, being destroyed, will run into the middle trench, and be conducted immediately off to the underground cistern; while the flames will be unable to spread thereto because of the air seal. The oil which supplies food for the flames being rapidly removed, it only remains to block up the door openings with earth to smother the fire. We have selected these engravings from the (Belgian) *Bulletin du Musée.*

Fig. 1. Plan.

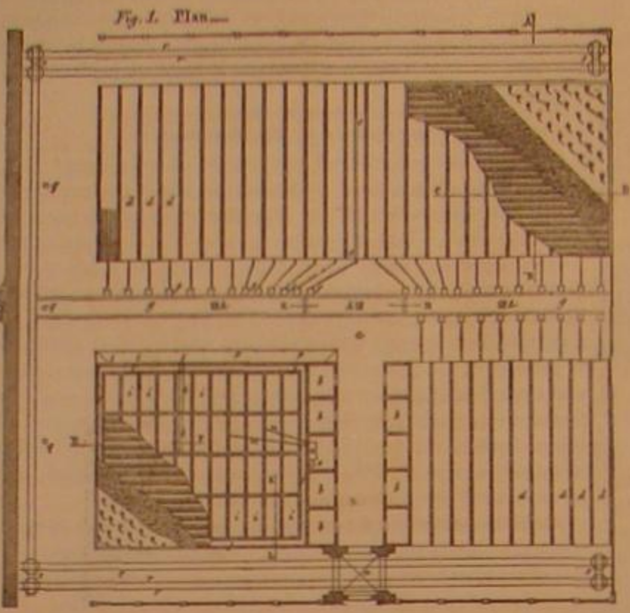


Fig. 2.

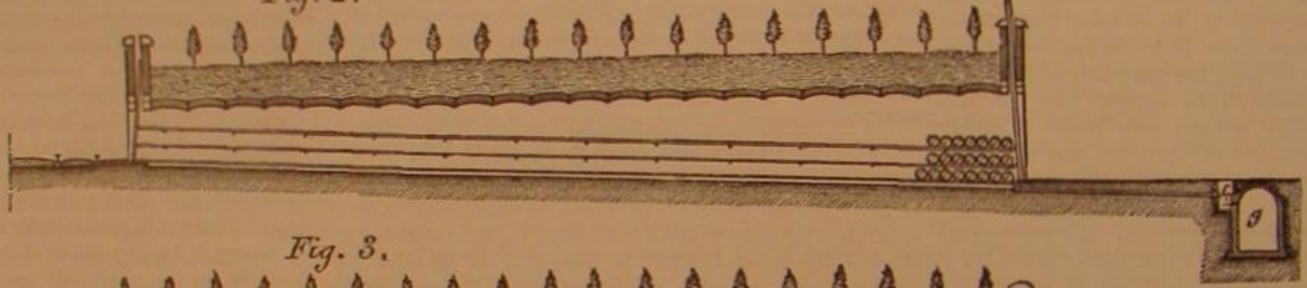


Fig. 3.

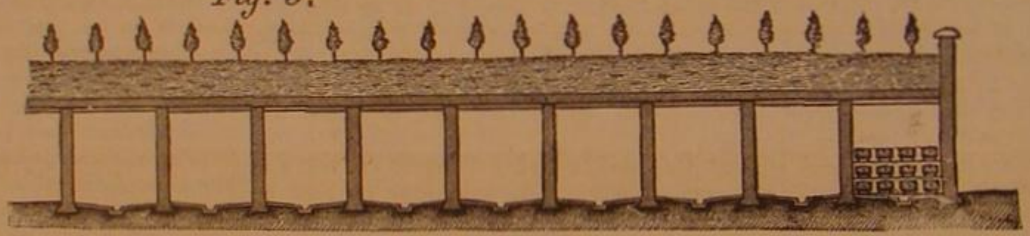


Fig. 6.

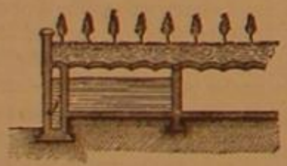


Fig. 5.

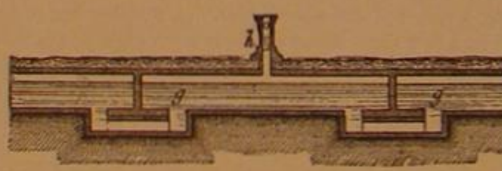


Fig. 4.

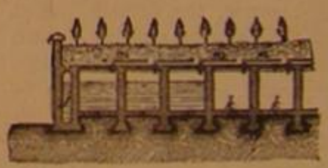


Fig. 7.

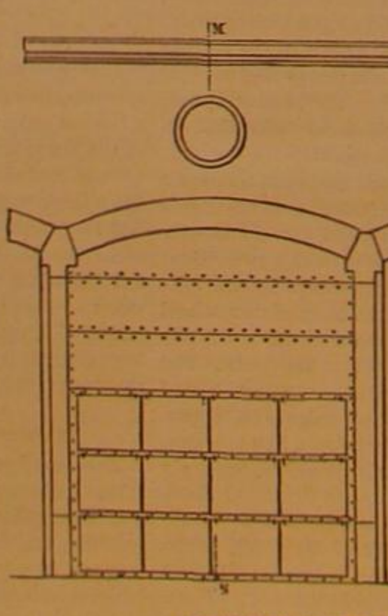


Fig. 8.

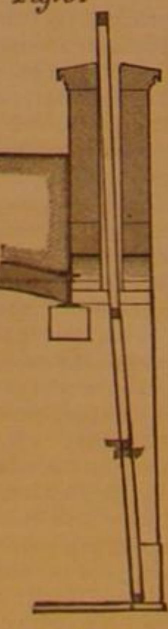


Fig. 9.

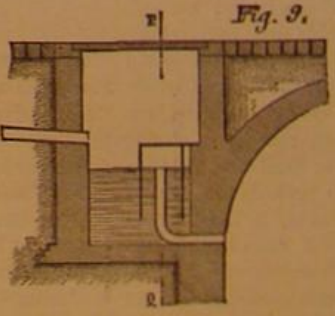
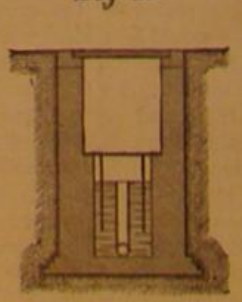


Fig. 10.



DONNY'S SYSTEM OF STORING PETROLEUM.

Barff's Method for the Preservation of Iron.

With regard to Professor Barff's paper, as to the prevention of iron and steel corrosion, a correspondent writes to the London *Times:*

"Without in any way desiring to detract from Professor Barff's merits as a discoverer of the process, and without wishing to depreciate whatever of practical value the invention may possess, I wish to point out two things which occur to me, namely, that Professor Barff has only re-discovered that which was known long since (and which, to my mind, should have been understood by every practical chemist), and that the principle is inapplicable in the case of iron to be used for constructive purposes, to which it is proposed to apply it.

"With regard to the first point, I may mention that, in the year 1861, I was engaged in investigating the merits of various apparatus for superheating steam in connection with the steam engine. In the course of my investigation I had brought before me one invention in which the patentees—Messrs. Parson and Pilgrim—passed the steam from the boilers to the engine through a coil of iron pipe placed in the boiler furnace. In support of the claims of the inventors for perfect safety in the process I had three reports, which are now before me. These reports are in print, and the first is from Dr. A. S. Taylor, Professor of Chemistry in Guy's Hospital, and Examiner in Chemistry to the University of London: it is dated April 26, 1859. After pointing out the absence of all danger in thus treating steam, Dr. Taylor observes that steam passed over iron heated to redness is decomposed, and that the oxygen is fixed by the iron while the hydrogen is liberated, the surface of the iron being rapidly covered with a fixed and impermeable layer of the magnetic oxide of iron which arrests the chemical action. The second report is dated the 28th of April, 1859, and is from Mr. W. T. Brande, F.R.S., who, after expressing an opinion upon the safety of the invention, states that the effect of high temperatures would be to cause a superficial layer of oxide of iron to line the interior of the heated pipes and to prevent the further decomposition of water. The third report is dated 'Royal Institution, 19th May, 1859,' and attached to it is the revered signature of Professor Faraday, who was consulted by the Board of Trade in the matter. After likewise testifying to the safety of the process propounded, Faraday observes that if the tubes were overheated 'a slow oxidation of the iron might continue to go on within.' From these three reports, however, it is very clear that the method of coating iron with a protective skin of oxide by means of steam was known in the year 1859, and that in Professor Barff's system we only have a re-discovery of an ascertained fact.

"Upon my second point I would observe that however well the process may be suited for pots, pans, and waterpipes, as suggested in the first lecture—and this requires practical proof—it is, to my mind, quite unsuitable for iron and steel for constructive purposes. For the latter uses these metals are required to be of the highest possible character and to stand certain definite tests, and this on leaving the manufacturers' hands. To my mind, it would most seriously alter the character of the metal for the worse were it to be submitted to such a process as Professor Barff's, and a grave element of danger would at once present itself. It would, moreover, be impossible to deal with large compound iron structures such as bridge girders, roof principals, and the like, as a whole, and he would be a bold engineer who would tamper with the component parts of such structures individually in the manner required for the method of preservation suggested. The best preservative of iron under these and most conditions is good reliable paint, having an iron oxide base, and, until it has been practically demonstrated to the contrary, I shall continue to consider such a process as is suggested as a dangerous and delusive innovation and not an improvement."

Bank of England Notes.

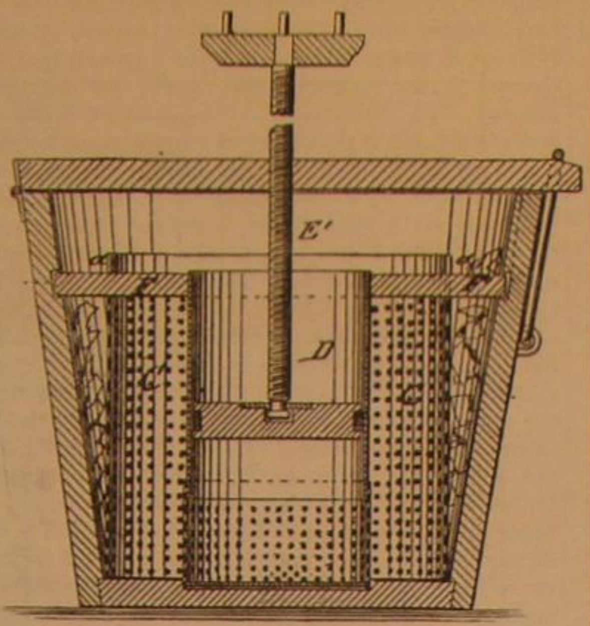
Few of the persons who handle Bank of England notes ever think of the amount of labor and ingenuity that is expended on their production. These notes are made from pure white linen cuttings only, never from rags that have been worn. They have been manufactured for nearly 200 years at the same spot—Laverstoke, in Hampshire, and by the same family, the Portals, who are descended from some French Protestant refugees. So carefully is the paper prepared that even the number of dips into the pulp made by each workman is registered on a dial by machinery, and the sheets are carefully counted and booked to each person through whose hands they pass. The printing is done by a most curious process in Mr. Coe's department within the bank building. There is an elaborate arrangement for securing that no note shall be exactly like any other in existence. Consequently there never was a duplicate of a Bank of England note, except by forgery. According to the *City Press*, the stock of paid notes for seven years is about 94,000,000 in number, and they fill 18,000 boxes, which, if placed side by side, would reach three miles. The notes, placed in a pile would be eight miles high; or, if joined end to end, would form a ribbon 15,000 miles long; their superficial extent is more than that of Hyde Park; their original value was over $15,000,000,000, and their weight over 112 tons.

Value of the Eucalyptus.

We learn from the *Meteorological Magazine* that, at the Easter *réunion* at the Sorbonne, some information was given by Dr. de Pietra Santra, a delegate from the Climatological Society of Algiers, as to the results of an investigation made in Algeria to ascertain the importance and value of the *eucalyptus globulus* in relation to public health. It appears that reports were received from fifty localities where the aggregate number of blue gum trees is nearly one million, and from these reports the following conclusions have been drawn: (1) It is incontestably proved that the eucalyptus possesses sanitary influence; for (2) wherever it has been cultivated intermittent fever has considerably decreased both in intensity and in frequency; and (3) marshy and uncultivated lands have thus been rendered healthy and quite transformed. Similar results have been obtained in Corsica, where it is computed that at the end of the present year there will be upwards of 600,000 plants of eucalyptus in full growth.

A NEW MECHANICAL BUTTER-WORKER.

Mr. Charles A. Sands, of Burlington, Kan., has patented through the Scientific American Patent Agency, May 1, 1877, the improved butter-working apparatus represented herewith.



In the tub is a cylindrical perforated screen, C, that forms with the tub an ice chamber. A follower is raised or lowered by the screw, E', in an interior cylinder, D, by a top handwheel. The lower part of the cylinder D is perforated, for the purpose of forcing the butter from the interior through the perforations into the space between screen and cylinder.

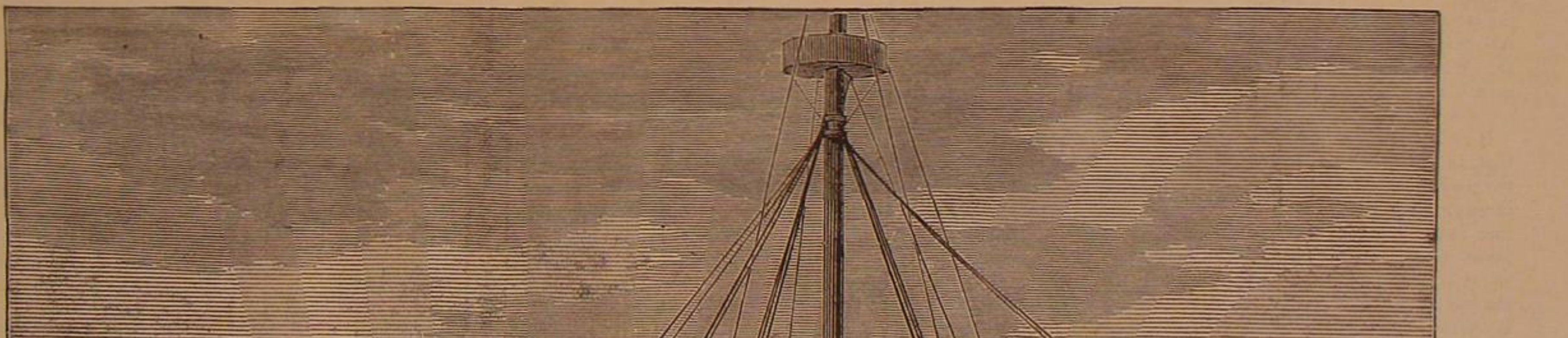
When the tub is used for work it is filled with water, which is cooled by the ice placed between screen and tub. The cold water rises to the same level in the interior cylinder as in the outer screen, the butter being placed into the cylinder and forced down by the action of the follower, lowered by the handwheel of the screw shaft. The butter then rises in finely separated condition, vermicelli-like, through the cold water in the space between the cylinder and screen to the surface of the same, when the same process may be repeated, if necessary, to separate the buttermilk entirely from the butter, which is at the same time kept cool for salting. The finely divided condition of the butter exposes the same thoroughly to the washing action of the water, so that the milk is quickly and effectively separated.

Zymotic Diseases.

Sir Thomas Watson has published a paper on zymotic diseases, in which he contends, in opposition to Dr. Murchison, that the development of the whole group, including small pox, chicken pox, typhus fever, typhoid or enteric fever, scarlet fever, the plague, measles, whooping cough, and mumps, is due solely to contagion. He would adopt, therefore, for the abolition of these diseases a process analogous to that which proved so successful in staying the cattle plague of 1865 in Great Britain. Of course he does not advocate the killing of the victims of contagia, according to act of Parliament or of Congress. Human beings cannot be stamped out like cattle, suffering from however grievous a contagium. But he would have the State exercise such powers as will insure, first, the immediate isolation of a person affected; second, the thorough disinfection of his body, clothes, furniture, and place of isolation, and, third, vigilant and effectual measures to prevent the importation of his disease from abroad, and to strangle it should it by mischance return. All this contagia-exterminating process implies, as Sir Thomas perceives, an acquaintance, on the part of the physicians to be employed by the commonwealth, with what he describes as the "science of State medicine," as well as an increase of taxation. But the freedom of nations from a class of diseases which may at any moment, and in localities where the sanitary arrangements are otherwise as good as they can be, send thousands to premature graves, is surely a worthy object of civilized society.

Professor Esmarch on Cancer.

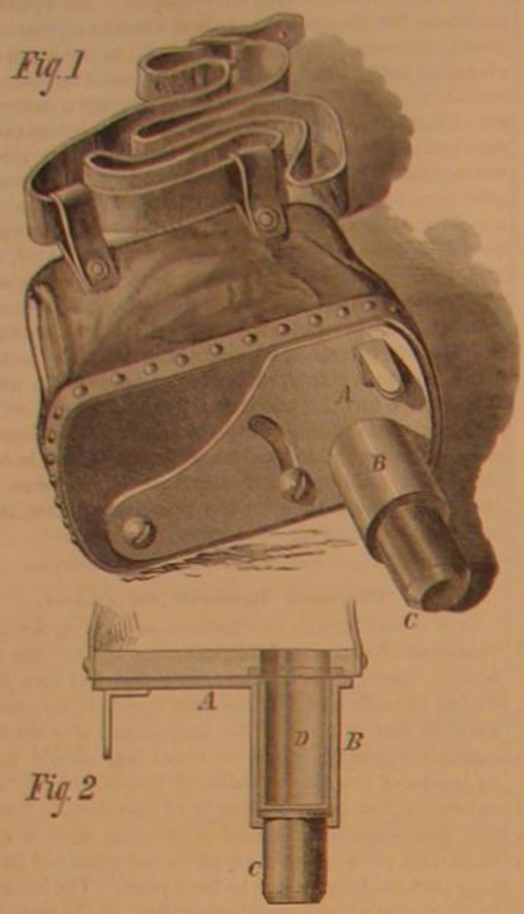
In a recent lecture, this eminent surgeon spoke upon the treatment of cancer. A large number of drawings were exhibited, showing the various cases that had been met with during the course of Dr. Esmarch's professional career. He advised that cancers of the tongue, and also most of the malignant growths, wherever occurring, should be treated by means of arsenic and iodide of potassium, internally and externally, before proceeding to an operation. The speaker had frequently seen cancer originating upon a syphilitic basis, and often where the syphilis had remained latent for a long period—from twenty to forty years. The lecture closed by an appeal to each member to collect all the material in his power, and so see if it were not possible, by a division of labor, to arrive at some definite conclusions on the question of malignant neoplasms.



A BRITISH MAN-OF-WAR PROTECTED AGAINST TORPEDOES BY NETTINGS.—(See page 3.)

IMPROVED SHOT BAG AND CHARGER.

By means of the device represented in the annexed illustration, any given quantity of shot may be quickly removed from the bag. A charge of exact quantity is portioned out, and no shot is lost in the operation. The bag, which is of leather, has a wooden bottom. The aperture for the escape of the shot in the latter is covered by the plate, A, which is pivoted, and the movement of which is limited by the pin entering the curved slot, as shown. Attached to said plate



is a tube, B, inside of which, at the outer end, is a flange. This tube, when the plate, A, is placed as shown in Fig. 1, registers with the aperture in the bag bottom. In the tube is inserted a plug, C, the flanged head of which, catching on the interior and flange of the tube, prevents its falling out. Above said plug, C, is inserted a cylindrical charging vessel, D. When this is in place, its mouth comes flush with the inner side of plate, A.

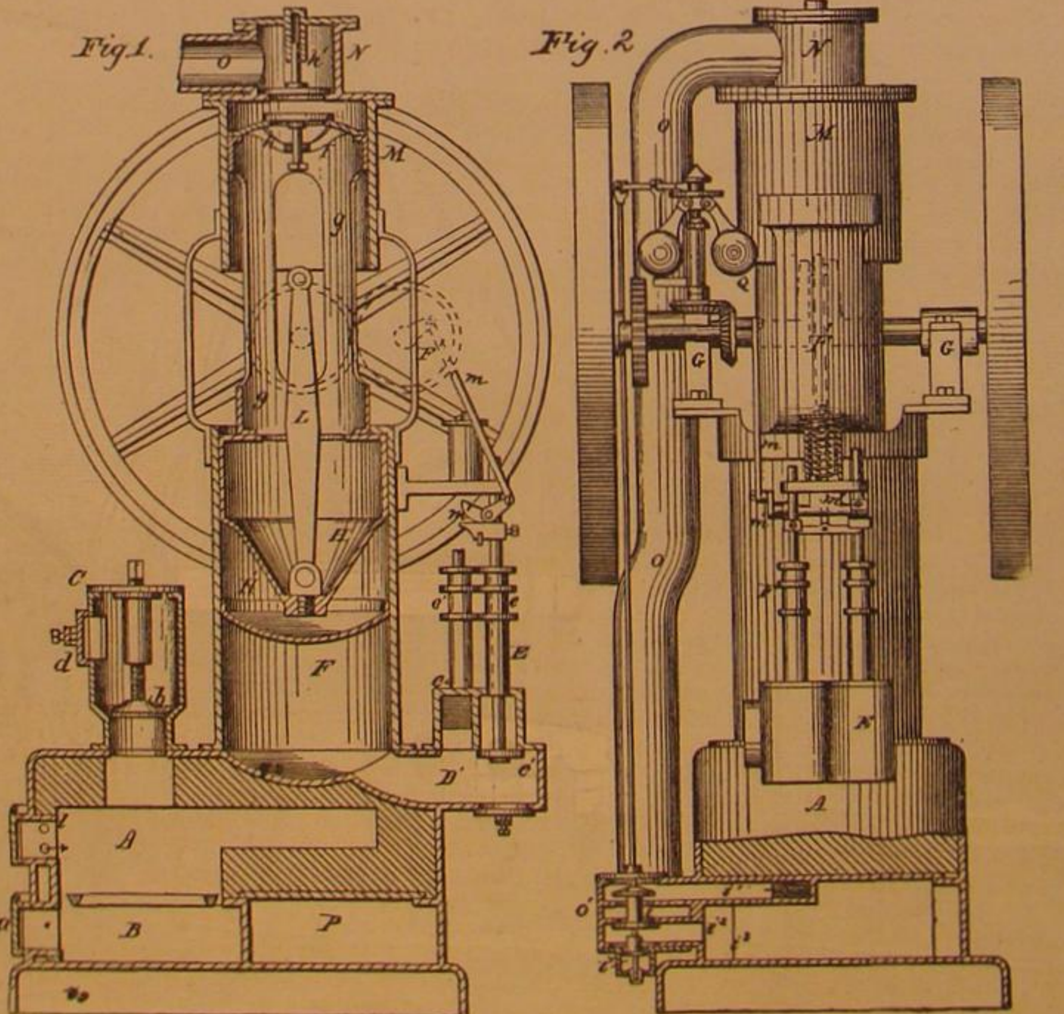
It will be clear from Fig. 2 that, in the position shown of the parts, the shot will descend through the aperture in the bottom and fill the charger. The pivot plate, A, is then moved so as to bring the tube clear of the bag; and at the same time it keeps the bottom aperture closed. By pushing upon the plug, C, the charger, D, filled with shot, is readily lifted out, so that the shot may be placed in the gun. The bag may be slung around the neck by straps, and is easily operated with one hand.

Patented through the Scientific American Patent Agency, May 15, 1877. For further particulars relative to sale of patent, royalties, etc., address the inventor, Mr. Thomas J. Jolly, Etna, Scotland county, Mo.

A NEW HOT-AIR ENGINE.

In the novel hot-air engine illustrated herewith, the atmospheric air is forced, by means of an air pump, into an hermetically closed furnace, where it is heated, and then conducted into the cylinder for use. The new feature is an improved mechanical distribution of air above and below the grate by means of the governor before the same opens a regulating cold-air discharge valve.

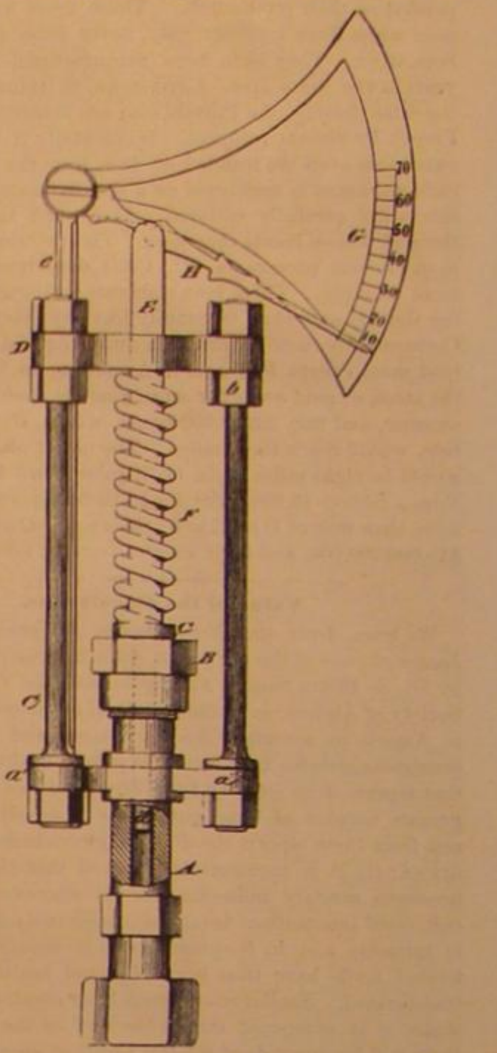
Fig. 1 represents a vertical longitudinal section of the motor, and Fig. 2 is an end elevation. A represents the cast iron furnace that forms the base section. Concentrically above the circular grate is arranged a box, C, whose contracted throat is closed by a valve, *b*, that is raised or lowered to open or close the communication for supplying the required quantity of fuel to the furnace during the running of the engine. The fuel is filled into the box through a hermetically sealing door, *d*, which is firmly closed by a fastening screw, so that the fuel box may, by closing the connecting valve, *b*, be filled, and the fuel then supplied after the door is closed and the valve opened to the grate, without any admission of air through the fuel box to the furnace. At the rear end of the furnace casing, opposite the fire door, is arranged a chest, E, with the hot air valves, *e* and *e'*, of which the air-supply valve, *e*, connects by a channel, D, with the cylinder, F, while the exhaust valve, *e'*, forms, by a second channel, D', the communication of the cylinder, F, to the chimney. The cylinder, F, is arranged vertically on the furnace box, and is provided at its upper end with four horizontal flanges, F', of which two opposite flanges carry the journal boxes, G, of the driving shaft, that is placed diametrically across the cylinder, while the other two are extended in upward direction, to support the air pump at the upper part of the engine. The piston, H, of the hot-air cylinder, F, and the piston, I, of the air pump, M, are concentrically connected by a tubular piece, *g*, that is broken out to give play to the crank of the driving shaft. The crank shaft is connected directly by a crank rod, L, with the cylinder piston, H, which is provided with a suitable leather or other packing, and inclosed by a sheet metal casing, H'. The piston, I, of the air pump, M, is also tightly packed with leather, and provided with a central suction valve, *h*, in the upper part of the piston. The suction valve, *h*, is opened during the downward motion of the piston, I, to draw in the required quantity of air, which is forced by the upward stroke of the piston through a second valve, *h'*, into a dome, N, secured to the top part of the air pump. The cold air is then conducted from the dome, N, and through the cold air tube, O, to the air regulator, O', which is arranged at the side of the furnace box, communicating by a valve, *i*, and an upper channel, i^1, directly with the grate, and by a lower opening, i^2, with the heating chamber, P, back of the ash box, and from the same by side channels, i^3, to the front part of the furnace back of the fire door. The partially heated air is forced through openings, *l*, back of the fire door into the furnace, where it is heated to the required degree and conducted to the cylinder, for working the piston of the same. The introduction of the atmospheric air back of the fire door keeps the same cool, while the side channels protect the furnace walls against too rapid deterioration. The governor, Q, is worked by gear wheel connection with the driving crank shaft, and arranged to operate, by a fulcrumed lever and rod, the valve, *i*, of the air regulator, O'. The governor shaft is also connected by a crank pin and rod, *m*, with a cam shaft, *m'*, that bears alternately the spring-ac ed top plates of the spindles of the air-supply and exhaust valves, *e* and *e'*. When the engine is at rest, the valve, *i*, is shown in raised position by the weight of the governor balls, and admits thereby the direct entrance of the cold air from the conducting tube to the grate, until, by the gradual increase in speed, the governor lowers the valve, *i*, so as to close the upper channel and conduct the air into the heating chamber, P, and to the furnace, in the manner described. If the speed of the engine, and consequently the pressure of the air within the engine, exceeds a certain limit, the governor rod depresses and opens a regulating exit valve, i^4, below the valve, *i*, so as to reduce in this manner, by the escape of cold air, the pressure in the lower part of the engine. This invention was patented through the Scientific American Patent Agency, May 8, 1877, by Messrs. J. Hock and L. P. Martin, of Vienna, Austria.



HOCK AND MARTIN'S HOT-AIR ENGINE.

IMPROVED PRESSURE GAUGE.

The annexed engraving represents a novel gauge for indicating pressure in hydraulic cylinders. It consists of a solid



piston of small area, whose outward motion is opposed by a strong adjustable spiral spring, and whose outer extremity is connected with an index that moves in front of a graduated arc. A is the cylinder, provided at its upper end with a stuffing box, B, and having at its lower end a coupling for connecting it with the hydraulic cylinder in connection with which it is to be used.

Arms, *a a'*, extend laterally from the cylinder A, for receiving the studs, C, which are secured thereto by nuts and extend beyond the stuffing box, B, parallel to the axial line of the cylinder, A. The outer ends of the studs, C, are threaded, and upon them a centrally bored crossbar, D, is placed between nuts, *b*.

A rod, E, passes through the crossbar, D, and extends downward through the stuffing box, B, into the cylinder, A, and is reduced in size, forming a piston, *d*, that fits the said cylinder.

A collar, *c*, is formed upon the rod, E, between which and the crossbar, D, a spiral spring, F, is placed upon the said rod. A standard, *e*, is secured to the bar, D, and supports a graduated arc, G, to which is pivoted an index, H, which is engaged by the upper end of the rod, E. As pressure is exerted on the piston, *d*, it is moved outward against the resistance of the spring, F. This motion is multiplied by the index, H, which indicates on the graduated arc the pressure per square inch in the hydraulic cylinder. The spring, F, is adjusted so as to offer more or less resistance to the pressure by moving the crossbar, D, by means of the adjusting nuts, *b*.

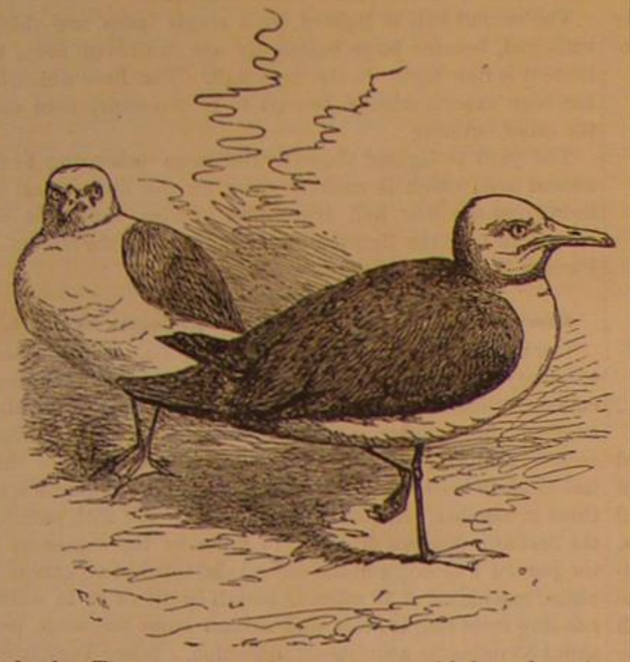
Patented through the Scientific American Patent Agency, May 15, 1877, by Mr. W. T. Snyder, of Catasauqua, Pa.

TO TIN ZINC.—Make a bath of distilled water 1 gallon, pyrophosphate of soda $3\frac{1}{4}$ ozs., fused protochloride of tin $\frac{1}{2}$ oz. A thin coat of tin can be obtained by simply dipping the zinc in the bath, and one of any thickness by the aid of the battery.

AN AUSTRALIAN GULL.

Our illustration shows the Jameson's gull, a bird of New South Wales, and one of the few new species which the *fauna* of Australia has added to the collections of the Old World. The duck-like form of the head and neck and the rotundity of the body are among its chief characteristics.

The gulls are noted for their great wing power and their voracity; they breast the fiercest gales, and swim well, but



slowly. They prey upon fish eggs, young birds, and carrion. Their eggs are edible, and are good food; and the young ones are killed and eaten by the fishermen of Labrador and Newfoundland. The plumage is soft and thick, and is much used in some northern countries as material for pillows, etc.

An English Village of Nail Makers.

It is always dingy and depressing in these villages, which, in a manufacturing sense, "feed" the large Black Country towns. Sulphurous fumes taint the air, and impart to it strange flavors that may be tasted on the lips as the salt of the sea may be tasted miles distant from the coastline. The roads, which in dry weather resemble nothing so much as caked boot blacking, yield puddles and rivulets of ink when it rains—which hereabouts it does with charitable frequency. There is "grit" everywhere.

The operatives, with a few exceptions, are women and children. Nor are these daughters of Vulcan mere make-believe workers. There are matrons—the mothers of the boys and girls that swarm about the hearth and forge (the youngest disporting with "clinkers" for playthings amongst the warm ashes)—and women old enough to be grandmothers, with hair stunted and gray. Young women, too—unmarried lasses, with colored handkerchiefs bound round their heads, to keep their cherished tresses from smoke and singeing, and with another kerchief in lieu of a bodice, bare-armed to the muscular shoulder; and one and all are cheerfully "hard at it," tugging the bellows, attending the forge fire, or facing each other at the anvil, hammer in hand, and with the glowing metal between. Some of these sooty Amazons, by a curious mechanical contrivance, work with two hammers at one and the same time: the one, the heavier, being set going by means of a treadle, and the lighter implement in the hand. They are making nails of all sizes, from the smallest brad to the 6 inch bolt-headed "spike."

It is terribly hard work and very badly paid. For instance, for making what are called "No. 6 clasp," which weigh two hundred to the pound, the pay is twopence a pound—a shilling for six pounds; and if found to be as much as an ounce overweight the work is "tailed," as it is called, to the extent of a penny in the shilling. A woman must work twelve or fourteen hours a day at the forge to earn about $1.75 a week; and not one in a hundred earns as much as $2.25 by her own unaided labor. But the inducement is that a child old enough to crack cherry stones with a hammer can assist at nail making, and "every little helps towards the mickle." Mere babies can earn 50 cents a week; and where there are six or eight children of various ages, the total earnings amount to something considerable. The houses are built for the purpose. To each one is attached a "stall" or "hearth," the separate rent of which is fourpence a week, a mite of a place, occupied chiefly with the hearth and the bellows, and affording so little elbow-room for the half dozen workers within that it appears a marvel they are not seared all over the exposed part of their bodies by the flying sparks and redhot chips. They are what are called free workers, being paid according to results.

Nails of every shape and form appear to be an article of commerce for which the demand seldom slackens, and it is impossible to produce too many of them. The merchant of whom the nailer buys his "rod"—the more or less substantial iron wire from which the goods are manufactured—is always willing to receive nails at the fixed price; and in the case of industrious families, once a week may be seen the edifying spectacle of father and mother and a troop of youngsters, ranging in age from 5 to 15, walking in Indian file, and each the bearer of a load of rod iron, thin and thick, to be made up during the ensuing week.—*Ironmonger.*

THE FOUNTAINS AT ARANJUEZ.

On page 343 of our volume XXXVI. we illustrated and described the celebrated Triton fountain in the royal domain at Aranjuez, Spain; and we now present to our readers a view of another, situate in the same beautiful park. The water display is, as will be seen in the engraving, very elaborate and tasteful; and the fountain is decorated with sculpture, and backed by a massive cluster of fine trees.

The palace and park at Aranjuez were built and laid out under the direction of Philip II., and immense sums of money were expended on the work. It is one of the most renowned country palaces of Europe, and a visit to it is generally part of a foreigner's travels in Spain.

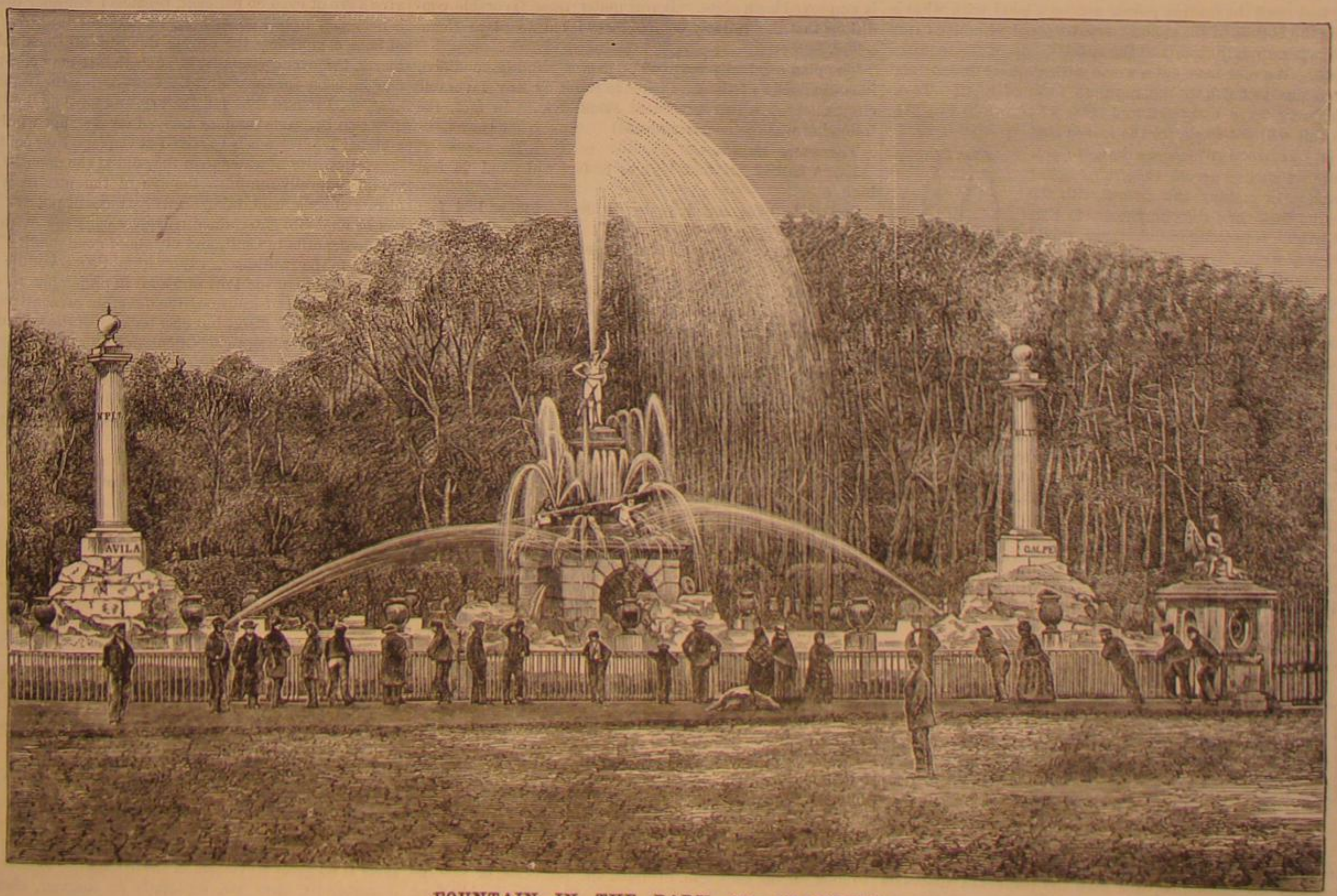
THE PENGUINS.

Of the numerous family of web-footed, imperfectly winged birds, the king penguin (*aptenodytes Pennantii*) may be taken as a specimen. The whole genus is characterized by the slender bill, with an acute tip, by the close-set plumes on the upper mandible of the bill, and by the fin-like wings, which are utterly useless for purposes of flight, having only short imbricated plumes with flattened shafts. The numbers of

these birds found in different parts of the world are incredible; round Cape Horn, the Falkland Islands, the Straits of Magellan, and the South Pacific they are to be found in crowds that defy computation. The immense deposits of guano in the islands of Peru show how numerous these birds become, being strong, vigorous, tenacious of life, and prolific.

Novel Joint Stock Company.

Signor Parnetti has been engaged for the last four years in analyzing the dust and *débris* of the streets of Florence and Paris. His investigations of the *débris* of the horse paths proves that the dust contains 35 per cent of iron given by the shoes of the horses to the stones. In the dust from the causeways this eminent chemist finds from 30 to 40 per cent of good glue. Signor Parnetti selected and treated separately the dust from the causeways of the Boulevard des Italiens over a period of two months, which uniformly gave 30 per cent of good transparent glue, it is said, quite equal to Belfast glue. He contemplates placing his discoveries at the disposal of a limited company, with the view of establishing blast furnaces on the banks of the Thames, to recover the iron thus lost, and a large glue works, which, it is thought, will produce more glue from the wasted material than will supply all London for every purpose.—*Iron Trade Exchange.*



FOUNTAIN IN THE PARK AT ARANJUEZ.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

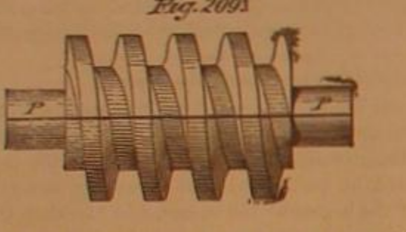
New Series—No. XXIX.

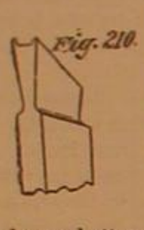
PATTERN-MAKING.—THE WORM OR ENDLESS SCREW.

A worm pattern, when cut by hand, involves a slow and tedious operation; and even with the utmost care we can scarcely expect to produce an article so perfect as it would be if cut in a screw-cutting lathe. But however well adapted the screw-cutting lathe may be for producing good screws in metal, it will not be found to give such good results when wood is the material to be operated upon; this may be accounted for by reason of the high speed required to make a clean job with wood in a lathe, which is altogether incompatible with the working of the gearing necessary for cutting screws, at least of such fast pitches as are usually required for worms. Besides, special tools must be made for use in the lathe, conforming to the shape of the tooth; for a worm is really one long tooth wound about a cylinder. There are a few other minor difficulties attending the cutting of a wooden worm in a screw-cutting lathe; and when all are considered, it is doubtful if there is much gain over the old-time hand method. We will, however, describe both:

Let Fig. 209 represent the complete pattern. To make it in either way, take two pieces, each to form one half of the pattern; peg and screw them together at the ends, an excess of stuff being allowed at each end for the accommodation of such screws or dogs, if the latter are more convenient, as they might be in a large pattern. Turn the piece down to the size over the top of the thread, after which the prints, P P, are turned. Supposing it to be determined to cut the thread in a lathe, we must have ready a few tools adapted for the work, the first of which is the parting tool, very similar to a parting tool for brass, Fig. 210, namely, flat and

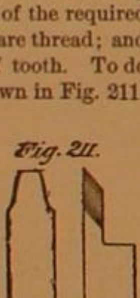
Fig. 209.





level on the cutting face, but with a great deal more bottom rake, as strength is not so much an object, and the tool is more easily sharpened. We have also in addition a little projection, like the point of a penknife, formed by filing away the steel in the center; these points are to cut the fibers of the wood, the severed portion being scraped away by the flat part of the tool. We must not forget to give a side rake to the tool corresponding to the pitch we have to cut; and the width of the tool is to be a shade narrower than the space in the worm at the narrowest part, which is generally at the root of the tooth. Having suitably adjusted the change wheels to the pitch required, we drive down the parting tool until the leading points are on a level with what is to be the bottom of the spaces; a parting tool without cutting points is now adjusted, and the space made of the required depth. We now have cut a worm with a square thread; and it remains to finish to the required form of tooth. To do this, some have essayed a tool such as shown in Fig. 211; but this will not work, for the reason that it is end wood which we have to cut. Were we cutting across the grain, as, for instance, in making the groove with the parting tool, then the one shown in Fig. 211, which is nothing but a scraper, would act very well. The tool shown in plan and section, Fig. 212, has a keen edge imparted to it by piercing a hole through the steel and filing to a bevel; it must then be nicely oil-stoned. The only objection to this tool is the difficulty of sharpening it. We ought not to suffer both sides of the tool to cut at once; in fact, the tool itself should not be made quite so wide as the space it has to finish. Furthermore, if the pattern is very large, it will be necessary to have two tools for finishing, one to cut from the pitch line inwards and the other to complete the form from the pitch line outwards. It is advisable to use hard wood.

Fig. 211.



If it is decided to cut the thread by hand, then, the pattern being turned as before, separate the two halves by taking out the screws at the ends; select the half that has not the pegs, as being a little more convenient for tracing lines across. Set out the sections of the thread, A, B, C, and D, Fig. 213, similar to a rack; through the centers of A, B, C,

Fig. 212.

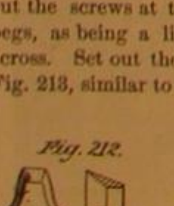
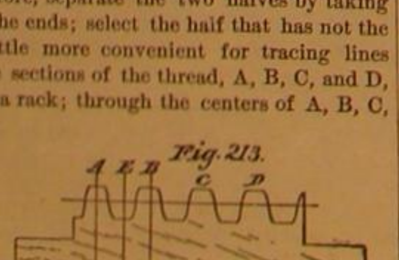


Fig. 213.



and D, square lines across the piece; these lines, where they intersect the pitch line, will give the centers of spaces on that side: or if we draw lines, as at E, F, through the centers of the spaces, they will pass through the centers of the teeth (so to speak) on the other side; in this position, complete the outline on that side. It will be found, in drawing these outlines, that the centers of some of the arcs will lie outside the pattern. To obtain support for the compasses, we must fit over the pattern a piece of board such as shown by dotted lines at G H.

We have now to draw in the top of the thread upon the curved surface of the half pattern; for this purpose, we take a piece of stiff card or other flexible material (see Fig. 214); we wrap it around the pattern and fix it tempo-

Fig. 214.

Fig. 215

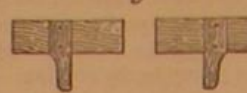
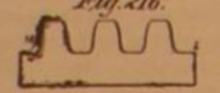


Fig. 216.



rarily by tacks, trim off the edges true to the pattern, and mark upon the edges of the card the position of the tops of the thread upon each side; we remove the card and spread it out on a flat surface, join the points marked on the edges, as in Fig. 214, replace the card exactly as before upon the pattern, and with a fine scriber we prick through the lines. The cutting out is commenced by sawing, keeping of course well within the lines; and it is facilitated by attaching a stop to the saw so as to insure cutting at all parts nearly to the exact depth. This stop is a simple strip of wood and may be clamped to the saw, though it is much more convenient to have a couple of holes in the saw blade for the passage of screws. For finishing, a pair of templates, Fig. 215, right and left, will be found useful; and finally the work should be verified and slight imperfections corrected by the use of a form taking in three spaces, as shown in Fig. 216. In drawing the lines on the card, we must consider whether it is a right or left handed worm that we desire. In the engravings, the full lines are those suitable for a right and the dotted lines for a left handed thread. Having completed one half of the pattern, place the two halves together; and trace off the half that is uncut, using again the card template for drawing the lines on the curved surface. The cutting out will be the same as before.

The Electric Light.

In consequence of experiments made in 1876 at the Paris passenger station of the Northern of France Railway Company, it was decided that the best place to apply the electric light was at the goods department of the station named, where work is carried on during the whole night long.

As a general rule, the saving effected in the establishment of a system of lighting is the greater the longer the lighting is employed each night. It was under these favorable conditions that the railway companies wished to place themselves.

The plan originally resolved upon was slightly modified, in consequence of the care taken to profit by any favorable circumstances which presented themselves. In fact, the following was the course adopted:

There were lighted—

1st. A hall of 224 feet long by 82 feet wide, and 26 feet high.

2nd. A hall 224 feet long by 50 feet wide, and 26 feet high.

3d. A yard 65 feet square, which separated the hall from the cart shed.

The hall is lighted by two lamps placed over one of the diagonals, and consequently in an unsymmetrical but very favorable manner. The lights are 14½ feet from the ground, in large square lanterns. The glass of these lanterns is painted white inside, and up to such a level that at no part of the hall can the voltaic arc be perceived. The upper part of the glass of the lantern was left in its natural condition, and the bottom is left unglazed: the consequence being that the rays of light shine on the ceiling and walls of the hall, which have been lime-whitened, and reflect a light soft and very uniformly spread. The lighting of this hall was the principal object in view; it is very abundant, and that is necessary, because there are numerous small parcels amongst the large ones, whose labels it is necessary to be able to read and register upon the arrival and unloading of the packages at different parts of the hall. One can see well everywhere, even in the most distant corners of the space in question as well as in the little passages between the heaps of bales, and in spite of the shadows cast. One can see even sufficiently in the bottoms of the wagons which are being loaded or unloaded.

The following passage is extracted from a document which has been kindly lent with the authority of M. Sartiaux, the engineer of the works: "The lighting has been in daily operation for fifteen hours and a half, on an average, from January 17, 1877. The magnificent light spread in the halls allows work to be done with the utmost facility, the saving of labor effected thereby being estimated at 25 per cent. Each foreman does not require to carry a lantern in his hand to look for the packages, decipher the addresses, or seal the labels; the work, in fact, is done as easily as it could be done in the broad daylight. Two halls are found to be sufficient for carrying on the work where formerly three were necessary. Beyond all these direct results, the electric lighting has given indirectly the following advantages, which diminish the indemnities paid by the companies: It diminishes the mistakes of direction, and the delays consequent thereon, and the damage done in loading. . . It prevents various kinds of frauds to the senders of the goods, and, in fact, it facilitates surveillance, and diminishes theft."

The second hall is lighted by a single lamp, and this is sufficient, because large bales only are dealt with here; the lantern is like those in the first hall. The lime-whitening has been experimentally proved to be necessary here as in the other building.

The yard is lighted above by the lamp belonging to the second hall, which is entirely open on the long sides; the light from the first hall also shines in when the doors are open. In fine, the lighting is as good as in the streets of Paris.—*Fontaine's "Lighting by Electricity."*

Discovery of Extensive Nitrate Deposits in Chili.

The report of the engineer—Senor Vadilla—who was sent to survey and measure off the claims applied for at the place called Cachinal de la Sierra, has been forwarded to the Minister of the Interior, and published in the Government *Gazette*, and gives a fuller account of the discoveries than has hitherto been made known. The deposits in question are three in number, situated to the south of the 25th parallel; the first at a distance of about 16 miles to the southeast of the port of Paposo; and the second and third in an extensive plane, calculated at 18 miles in length by 18 or 20 in width, running from east to west, and distant from the same port about 55 miles, in a southeast direction. Senor Vadilla examined all the land in which prospecting had taken place, a large number of holes having been put down at different distances, in all of which beds of nitrate were discovered. Under the sandy surface a stratum is found which is in parts sulphate of soda of tolerable purity, and in others a mass composed of sulphates and of caliche, mixed with the surface sand. Under this is situated the bed of nitrate, which is from 40 to 60 inches in thickness. The deposits are considered to be of great extent, being met with in all the holes sunk, and also wherever the earth was removed to the depth of 20 inches by the inspecting engineer. The first deposit measured gave a superficial area of 300 acres; the second, 920 acres; and the third, 2,717 acres; or a total of about 5,000 acres. To obtain a fair approximation as to the quality of caliche, samples were taken from various localities, mixed together, and analyzed, the result being as follows:

Common result of the first deposit—lye		......	51·5 per cent.
"	" second "	....	29·7 "
"	" third "	....	41·7 "

"These lyes," says Senor Vadilla, "show the pure, anhydrous nitrate of soda contained in the caliche, and obtained not from isolated samples but from a number taken on the field itself, and with all the care possible in such a locality. I have not assayed separately any of the samples which composed the collective one, and some of which I believe would give a lye of even 80 per cent, because I consider that what is necessary to be known is if, throughout the great extent of land comprising the nitrate deposits of Cachinal de la Sierra, the average quality is such that it may constitute a new industry for the country. Considering the result of the analysis, I regard it as satisfactory, and have no doubt whatever that the same samples assayed on the spot would show a higher lye; for when I arrived at Copiapo they contained a larger quantity of water than they did at the deposits, which would naturally diminish the lye of the nitrate, which is nitrate of soda, containing scarcely traces of potash. There can be no doubt entertained whatever over the existence of nitrate deposits in Chili, and nitrate of good quality." With respect to the facilities of exportation, Senor Vadilla recommends the use of the Port of Taltal in preference to that of Paposo, not only because of the difficulty of constructing a road to the latter place, but also because of the insecurity of the bay. According to his calculations the deposits are situated at only eight or ten leagues from the road leading from Cachiyuyal to Taltal, to which a cartway might be easily made, the country being level and the distance short—Taltal being, besides, a well sheltered bay, and with facilities for loading and discharging.

Lightning Accidents.

During a recent severe hail and thunder storm at Hyde Park, a ball of fire ran along the telegraph wire, and entered the operator's room in the New York and New England railroad depot. It melted the connecting wire and damaged the instrument so badly as to render it useless. Miss Josephine P. Folsom, the operator, was near the instrument, but escaped injury, though much alarmed. Charles Gerry, a private operator, sustained a severe shock while at work at his instrument.

During the storm of June 6, the lightning followed the telegraph wires into the office of Thomas Haines, Superintendent of the Hestonville Railway Company, West Philadelphia, Pa., and prostrated that gentleman.

Father Secchi recently alluded to the remarkable connection between the magnetism of the earth and the changes of the weather. Variations shown by magnetic instruments are sufficient to indicate the state of the sky. Even where there is no great movement of the barometer, following such disturbances, there are, especially in summer, changes of the wind and sometimes storms.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

A patent was withdrawn from the issue of May 29 under the following circumstances: Mr. F. B. Hunt, of Richmond, Ind., applied for a reissue of letters patent No. 68,070, issued originally to Samuel Harpster (now deceased), August 27, 1867, which application was passed and the reissue dated May 29, 1877, and numbered 7,715. Mr. Hunt, immediately after the patent was allowed, issued notices to different manufacturers, warning them against infringing said patent, and furnishing them with a copy of the claims allowed. One of the manufacturers so notified, feeling satisfied that some of the claims of the patent were invalid for want of novelty, came on at once to this city, and employed counsel, who found a number of references to meet one, at least, of the claims, and thereupon applied to the Commissioner to withhold the patent, who, after examining the case and the patents cited as anticipating the claims, concluded to withdraw the patent from the issue, although it was already printed and signed; but as no seal was attached the document was not complete.

This case has caused a great deal of talk, because, first, the attorney who prepared the application for a reissue was the brother of the assistant examiner who has charge of the particular sub-class to which this application belonged; and secondly, the attorneys who opposed the case were formerly in partnership with the Commissioner. And although, under the circumstances of the case, he only performed his duty in preventing the issue of an invalid patent, the fact that he decided the case in favor of the party that employed his former partners has given the applicant and his friends grounds for considerable talk against the motives of the Commissioner in making the decision.

I see that it is being telegraphed all over the country that a patent has been granted to a gentleman in San Francisco for a method of telegraphing facsimiles of stereotype plates. There appears, however, to be nothing very extraordinary about this, it being only one of the many different styles of facsimile telegraph apparatus, but differing from the majority in using a stereotype plate for the "copy," which plate is filled up between the faces of the letters with a non-conducting substance that is very readily applied. The plate thus prepared is placed upon a cylinder arranged to revolve rapidly, so as to present each successive letter to fingers attached to a traveling frame. As the cylinder bearing the plate revolves, the frame gradually advances by the operations of a screw; and thus each and every line is successively presented to the fingers or magnetic points already mentioned. Necessarily the circuit is open when the points are passing over the non-conducting surface; but as often as the metal type presents itself to said fingers the circuit is closed, and the corresponding magnetic points or pens at the receiving station make the record there in the same letter as the original, delineated in a series of fine lines, either upon chemically prepared or ordinary paper, fixed upon a corresponding cylinder at said receiving station. There does not appear to be any very great gain in this system at present; but if some one will now devise some plan by which the instrument at the receiving station will be able to make a plate which will be an exact copy in relief of the original stereotype, it would appear that it would be a very valuable invention; for then the great daily papers could then issue their papers simultaneously in every large city in the country—which is something we may yet see.

Arrangements are now being made by the Ordnance Bureau of the Navy Department to convert a number of 100 lbs. muzzle-loading Parrott guns into breech-loaders, at the Parrott Foundry, near West Point. It is intended to place the guns so converted on some narrow beam vessels of the Alaska class. There is now being made for the Bureau at the Navy Yard in this city a number of breech-loading boat howitzers of 3 inches caliber; and it is hoped that every vessel in commission will soon be supplied with this class of weapons. The Trenton (the flagship of the European station) is the only vessel now supplied with them; but it is intended to furnish from one to three to each vessel, according to size. The Bureau finds itself unable to readily get any very heavy breech-loading guns made, for the want of any establishments in this country capable of making the heavy steel tubes which are essential for the lining of breech-loaders. The department is desirous of making some 12 inch rifles, weighing about forty tons, but there is no factory in the United States that is in a position to make even 8 inch gun tubes. Our ordnance officers do not think that such tubes cannot be produced here, but that not enough of them are wanted at present to make the manufacture of them profitable, unless the government should give an order for the making of enough guns to pay the manufacturer to furnish the necessary capital required for the plant capable of turning out such tubes. Some 11 inch muzzle-loaders have been converted into 8 inch rifles by inserting wrought iron tubes, which answer for muzzle-loaders, but not for breech-loaders. The former will do for seacoast and harbor defence, where there is room for working; but in cramped quarters, as on board ship, breech-loaders are the most desirable.

The War Department is considering a proposition to send one or more officers of the United States army to our legations in Turkey and Russia as military *attachés*, and to procure for them special permits to travel with the contending armies, so as to make observations of their tactics. The officers are to be in constant communication with this government, so as to regularly report the progress of the campaign from the standpoints of both countries, and on their return to compile their observations into a final report for general information.

For several years the Bureau of Navigation has made strenuous efforts to obtain a sufficient appropriation to make a proper survey of parts of the Pacific Ocean, and especially the coast between San Francisco and the Isthmus, for the benefit of our commerce between those places. The necessity of a proper survey of the very locality where the Pacific Mail Company's steamship City of San Francisco was recently wrecked was very much felt, and it was proposed to make such survey. Estimates were prepared for that purpose to be submitted to Congress; but the late Secretary of the Navy did not think it advisable to ask Congress for any money for this purpose, and the survey could not therefore be made.

Mr. Dodge, the statistician of the Agricultural Department, reports, as the result of an investigation of losses from diseases of swine during the past twelve months, the discovery of the destruction of 4,000,000 animals of all ages—a money loss of more than $20,000,000. It is intended that the department shall ask Congress for an appropriation to make an investigation to see if some remedy for this cannot be found.

The Chief of the Bureau of Statistics has published a statement that he has received information showing that there were exported during the month of April, 1877, 13,404,628 yards of cotton goods, valued at $1,055,967, and of other manufactures of cotton $144,539; in all $1,200,506—an increase in value over April of last year of about 36 per cent. Of the exports in April, 1877, 43 per cent were shipped to the United Kingdom and British possessions—which appears like sending coals to Newcastle.

From a recent telegram received in this city respecting the Sutro tunnel, designed to tap and drain the Comstock lode, it appears that this great work now reaches 17,000 feet from its mouth, and it is expected that it will progress hereafter at the average rate of about 300 feet per month. The work has now been prosecuted for nearly eight years, at an average cost, it is said, of about $1,000 a day. It is estimated that, in about ten months, it will tap the Comstock lode at the Savage mine; but it may take much longer, as some miners think that, when nearing the lode formation, the difficulties of tunnelling will be very much increased. Mr. Sutro, however, thinks they have passed through as bad material as they are likely to find in the future, and does not anticipate any serious trouble. Several quartz veins have been cut which have given tolerable assays; but the tunnel is not cut as a prospecting enterprise, and they therefore do not intend to turn aside from the main business of tunnelling until after the lode is reached.

Washington, D. C. OCCASIONAL.

Germination of Seeds under Blue Glass.

To the Editor of the Scientific American :

Having procured two small tin boxes, and filled them with garden soil, I put into each box 6 peas (each pea weighing exactly 6 grains), and 6 kernels of popcorn, each kernel weighing exactly 3 grains. One box I covered with strips of blue and common window glass, the proportion of blue to common glass being about four to one. The other box I covered with common glass. I watered the contents of the two boxes once a day with the same amount of water, at the same temperature. At the end of two weeks I removed the earth from the young plants by gentle agitation in water, carefully dried them between sheets of blotting paper, and weighed them, with the following results:

BLUE GLASS.			COMMON GLASS.		
No.	Corn. grs.	Peas.	No.	Corn. grs.	Peas.
1	*	*	1	19·0	*
2	19·5	37·0	2	23·5	36·5
3	16·5	33·0	3	23·0	34·5
4	16·0	21·5	4	16·0	37·5
5	16·5	31·5	5	26·0	17·0
6	16·5	19·5	6	18·5	*
Total....	85·0	142·5	Total.....	126·0	125·5
Average..	17·0	28·5	Average..	21·0	31·37
Increase..	14·0	22·5	Increase..	18·0	25·37

* Failed to germinate.

It will be seen that, after deducting the original weight of each, the average increase of the corn under the blue glass was 14 grains, while the increase of that under common glass was 18 grains, or four grains in favor of common glass. The average increase in the peas under blue glass is 22·5 grains, while under the common glass it is 25·37 grains, or 2·87 grains in favor of the latter. There was but little difference in the time of germination. The corn under the blue glass was streaked lengthwise of the leaf or blade, with deeper and lighter veins of green.

Woodstock, Ontario. J. MONTGOMERY.

The Egyptian Prolific Cotton.

To the Editor of the Scientific American :

The writer recently received a circular issued by a rural grange, reciting the fact of the discovery and proposing to form a club to send and purchase some of the seed of a wonderfully prolific Egyptian cotton plant. Signor Giacomo Rossi, the "discoverer" of this wonderful plant, states that it grows to the height of 10 feet, and the original stalk produced 70 bolls. From results attained by planting picked seed in small patches, and giving the plants special cultivation, a theoretical yield of 10 cantars of seed cotton per feddan (acre) is figured out for the new discovery. Now a cantar is a very uncertain unit of weight. In Palermo it is 44 lbs., in Rome it is 75 lbs., while in Alexandria and Cairo it is 45 lbs. scant. In Syria, the cantar means 450 to 500 lbs., or thereabout, being 10 Cairene cantars. Nowhere do I remember the cantar to have the value of 100 lbs., as stated in the article referred to. But taking it for granted that it is 100 lbs., we have a theoretical yield (which is never reached in practice) of 1,000 lbs. of seed cotton per acre—or just two thirds as much as is raised year by year on almost every single acre in this country, our average yield per acre being 1,500 lbs. seed cotton, or 500 lbs. lint cotton. Taking the results achieved by our best gins (on an average) the 1,000 lbs. seed cotton would make about 350 lbs. of lint—the usual yield of fair cotton land throughout the South.

This, however, is giving Signor Giacomo Rossi all that he claims theoretically, with figures of his own based upon results obtained by picked plants, and saying nothing about the difficulties in the way of getting cotton off stalks 10 feet high. The weed frequently grows that high here when it is neglected, and our planters sometimes have to "top," as it is called, hundreds of acres to prevent its growth to a height that would make picking inconvenient. Besides, the more stalk, after a certain amount, the less bolls. As to the results of special cultivation, I could refer you to the circulars of a half dozen different "prolific" cottons raised in different parts of the South, some of them with affidavits from our best citizens attached, setting forth the fact of 2½ and even 3 bales being raised from one acre—and that too on the red clay or sandy hills of Georgia. And granting that this original Egyptian stalk had 70 bolls on it, as claimed by Signor Rossi, that is no sign that plants grown from its seed will be equally prolific. On the contrary, all of our experiments—and they have been numerous—with "prolific," "improved," "multiplying," and other new kinds of cotton seed have proved to us that this plant is no exception to the general rule of atavism, and that in a generation or two, except under special cultivation, the plant generally reverts to the normal type of the plant produced in the country. Seventy bolls, however, are by no means a large number. On the plantation of James B. Best, about 2 miles from this point (Osceola, latitude 35° 42′ 30″ N.), I saw last year two stalks of cotton, upon one of which there were over 800 and on the other 1,000 "squares" and bolls (a square being a boll in process of development). All of this immense number did not come to maturity, owing to an early frost, which occurred on the first night of October; but had the plants had two weeks longer, almost every boll would have opened out. These plants were volunteers, and came up in exceptionally favorable spots. Mr. Best saved the seed to experiment with this season.

Osceola, Ark. F. L. J.

The Seventeen Year Locusts.

To the Editor of the Scientific American:

In your paper of May 26, I see an article on the seventeen year locusts. In this section of the country they appear every thirteen years; and at alternate appearances there are many more than at the others. Thus, in 1829, every bush was loaded with them, and young trees were so badly injured by their sting that the woods in July showed many more dead than live branches. All young apple and peach trees were killed. In 1842, they again made their appearance, but not in such numbers as in 1829; yet many trees were permanently injured then. In 1855, they came again by millions, and did about as much damage as in 1829. In 1868 they again visited us in about the same numbers as in 1842. The next appearance here will be in 1891, when they will probably be as plentiful as in 1829 and 1855.

Chesterfield, Ill. H. J. LOOMIS.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for July, 1877.

Mercury.

On July 1, Mercury rises at 3h. 19m. A.M., and sets at 6h. 5m. P.M. On the 31st, Mercury rises at 5h. 57m. A.M., and sets at 7h. 56m. P.M.

Mercury should be looked for in the morning of the early part of the month. It is very small and not very easily found.

Venus.

Venus, although small, is easily found after sunset. It rises on July 1 at 5h. 43m. A.M., and sets at 8h. 35m. P.M. On the 31st, Venus rises at 6h. 54m. A.M., and sets at 8h. 24m. P.M.

Mars.

Mars is coming into better position. It rises on July 1 at 10h. 57m. P.M., and sets at 9h. 36m. A.M. the next day. On the 31st, Mars rises at 9h. 23m. P.M., and sets at 8h. 11m. A.M. of the next day.

Astronomers will look at Mars with great interest in September. The planet then comes into its best position; and it can be observed in the evening and early in the morning. Astronomers expect to be able to determine its distance by observing how much its place changes when referred to the stars, by the change of position of the observer during this interval of time. The month of September will also be the best time for making drawings of the spots seen on the disk of Mars.

Jupiter.

Jupiter is, in July, the most interesting object in the skies. On July 1, Jupiter rises at 6h. 37m. P.M., and sets at 3h. 37m. A.M. of the next day. On July 31, Jupiter rises at 4h. 26m. P.M., and sets at 1h. 26m. A.M. of next day. Late in July, Jupiter comes to the meridian at 9 P.M., at an altitude of about 25°.

On July 4, at 9h. 30m. P.M., only three satellites of Jupiter will be seen, the first being in transit across the face of Jupiter; on the 7th of July, at 9 P.M., the largest satellite will not be seen, because it will be behind the planet; on the 8th of July the smallest satellite will be invisible, because it will be on the face of the planet; on the 20th and 27th of July the nearest satellite will not be seen at 9 P.M., because it is in front of the planet; the smallest will be invisible on the 24th, because it is behind the planet. On the 28th, a little after 9 P.M., a satellite will come out from the shadow of Jupiter. The best time to watch Jupiter, with a small glass, is when some one of the satellites is out of sight, as the reappearance is very interesting.

Saturn.

On July 1, Saturn rises at 11h. 7m. P.M., and sets at 10h. 25m. A.M. of the next day. On July 31, Saturn rises at 9h. 7m. P.M., and sets at 8h. 23m. A.M. of the next day.

Mars and Saturn are in conjunction on the 27th, Mars being lower than Saturn in altitude. During the last week in July, Mars, Jupiter, and Saturn can all be seen at 10 P.M. Jupiter in the southwest, Mars and Saturn in the southeast.

Uranus.

On July 1, Uranus rises at 8h. 6m. A.M., and sets at 9h. 54m. P.M. On July 31, Uranus rises at 6h. 16m. A.M., and sets at 8h. P.M.

Sun Spots.

The report is from May 19 to June 15, inclusive. The observation of May 19 showed a large spot coming on, but clouds prevented another observation until May 24, when a group was seen near the center. The spot seen on May 19 had probably broken up to form this. On May 26 the group was visible, but was very faint, and on May 27 it could not be found. From May 28 to June 4 the disk appeared to be free from spots. On June 5 a group of large spots was observed on the eastern limb, but clouds prevented observations, and, when next seen, it was near the center. On June 13 it could not be found, and it must have disappeared after passing the center. At the present date, June 15, the disk appears to be free from spots.

DECISIONS OF THE COURTS.

United States District Court.—District of Connecticut.

AUGER PATENT.—RICHARD P. BRUFF, trustee, vs. WILLIAM A. IVES.

[In Equity.—Before Shipman, J.—Decided April 12, 1877.]

Shipman, J.:

This is a bill in equity, charging an infringement by the defendant of reissued Letters Patent No. 5,624, dated October 21, 1873, which were issued to Richard P. Bruff, assignee of James Swan, for an improvement in machinery for manufacturing curved or gauge-lip augers. The original patent was issued to said Swan June 9, 1868. Since the suit was brought the patent has been assigned by the plaintiff and no injunction is now asked.

In the manufacture of augers the end of the bit-blank is first cut out into a trident-like shape, and the body of the blank is then twisted into the form of an auger. The central prong at the end of the blank becomes the pivot of the auger, and the two other prongs become the floor-lips or cutting edges. Formerly, these cutting edges were formed by hand. The operation of bringing or drawing the cutting edges so as to start from the base of the screw, and to continue in a line with the axis of the thread upon the pivot of the auger, was a difficult one and required skilled labor.

The patentee describes the object and nature of his invention as follows:

"In making augers or bits of the above description, namely, curved or gauge-lip augers, it is necessary to leave a sufficient thickness of metal at the bit to admit of the point or screw being formed, after which the lips require to be reduced and brought to a knife-like edge at their cutting parts, which process is termed upsetting, and has hitherto been done by hand; but the most skillful workman can scarcely obtain a perfect form of cutters, and perfect uniformity in the two lips is rarely ever obtained. In my invention I employ griping or clamping jaws that grasp and firmly hold the auger blank just above the lip, the jaws being fitted to receive the helical threads of the auger blank, and, in connection with these jaws, swaging or drawing dies, to which is imparted a rotative movement while they are in contact with the lips of the blank, such rotative movement upsetting the auger lips and forming them to shape against the griped dies."

The machine consists, in general, of two jaws, connected at one end by a pivot, which have dies inserted in their opposite ends, to receive and hold the screw portion of the auger while its cutters or lips are being operated upon. The specification describes the dies as follows: "The upper surfaces of the dies, B B, are grooved or hollowed out to conform to the desired shape of the lips or cutters, as shown at C C." An arbor is fitted upon the socket of a curved standard, which arbor rotates and moves longitudinally to and from the auger or bit. To the lower end of the arbor the swaging or drawing dies are fitted. These dies act upon the lips or cutters of the bit when the arbor is moved, and the lips are drawn out to a thin edge against the ends of the jaws by the rotative and forward action of the swaging dies. * * *

Decree in favor of the plaintiff for an accounting, and a reference to a master.

[*Thomas L. Livermore and Benjamin F. Thurston*, for plaintiff. *Charles R. Ingersoll and John S. Beach*, for defendants.]

Inventions Patented in England by Americans.

May 25 to June 7, 1877, inclusive.

Blind Furniture.—C. De Quillfeldt, New York city.
Closing Bags.—A. M. Underhill, New York city.
Corset, etc.—L. C. Werner, New York city.
Cutting Rails.—D. McCandless, Pittsburgh, Pa.
Dredging Machine.—D. Moor, Waterville, Me.
Feeding File Cutters.—H. B. Nickerson, Boston, Mass.
Folding Paper, etc.—S. D. Tucker, New York city.
Heating Cars.—Car Heating and Brake Co., Albion, N. Y.
Horseshoe Machine.—J. W. Chewning, Jr., Shadwell, Va.
Horseshoe Machinery, etc.—J. D. Billings, New York city.
Lamp.—G. Chappel, Brooklyn, N. Y.
Lubricant.—P. Sweeney *et al.*, New York city.
Ordnance.—B. B. Hotchkiss, Paris, France.
Pliers, etc.—C. N. Thorpe, Philadelphia, Pa.
Rolling Machinery.—A. Reese, Pittsburgh, Pa.
Sash Fastener.—N. Thompson (of Brooklyn, N. Y.), London, England.
Self-Lubricating Journal.—P. Sweeney *et al.*, New York city.
Splitting Leather.—J. A. Safford (of Boston, Mass.), London, England.
Stringed Musical Instrument.—M. H. Collins, Mass.
Twist Drill, etc.—C. F. Jacobson *et al.*, New York city.
Urinal.—J. W. Osborne, Washington, D. C.
Water Closet Valve, etc.—F. E. Kernochan, Pittsfield, Mass.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the Scientific American. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the Scientific American on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW AGRICULTURAL INVENTIONS.

IMPROVED MILK COOLER.

Elmore D. Bennett, Allegany, N. Y.—This invention relates to improvements in milk-cooling pans by which any quantity or mess of milk may be cooled separately from that in the remaining pans of the vat, the pans being cooled by spring water direct, or by water passing through an ice receptacle, the cold water being conducted around the pans, and drawn off at the end. A water vat is provided with any number of pans resting on cross pieces, and retained by fastening devices in the vat. The cold water is agitated by one or more rubber-lined partition strips, that are set laterally across the pans, and the vat divided by detachable partition strips into several vats, as required.

IMPROVED FRUIT DRYER.

William S. Plummer, Portland, Oregon.—This is an improved apparatus for drying fruit, so constructed as to enable large quantities of fruit to be dried at the same time, the drying being done quickly and evenly. The firebox, into which fuel is inserted through a chute, leading in through the lining and case, and which is provided with a door at its outer end. Upon the top of the firebox is formed a square drum, which projects beyond the sides of the firebox and has pipes passed through and secured in holes in the top and bottom plates of its said projecting parts, so that the flame of the fire may circulate around the pipes and heat the air passing through them. The smoke and other heated products of combustion pass into a coil which passes around the drum, and from which a pipe leads out through the lining and case.

IMPROVED CORN PLANTER AND GRAIN DRILL.

John L. Hill, Climax, Kan.—This machine is convertible, being adapted for use both as a corn planter and drill. When used as a cultivator suitable adjustment brings the concave sides of two inner cutters of each set inward to move the soil toward the plants, and the concave sides of the outer cutter of each set outward to hold the cutters against lateral movement.

IMPROVED SULKY ATTACHMENT FOR PLOWS.

William K. Bushnell, Burlington, Wis.—This improved sulky attachment for plows is so constructed as to leave the plow free to run in and out of the ground, to prevent it from wabbling, and to enable it to be readily controlled.

IMPROVED HORSE HAY RAKE.

John Badger, Belvidere, Ill.—This embodies improvements in horse hay rakes, by which the hay is cleaned completely from the rake teeth in dumping, and the teeth locked into rigid position when in operation, and readily adjusted to different heights from the ground.

IMPROVED HARROW.

David McIlrevey, Riceville, Iowa.—This harrow is so constructed that it will adjust itself to any unevenness of the surface of the soil. It cannot injure the horses or the driver by being thrown against them, and may be readily adjusted into a large or a small harrow, as required.

IMPROVED GRAIN SEPARATOR.

Louis V. Davis, Elkader, Iowa.—This is an improved grain separator of simple construction, which is mainly designed for the purpose of cleaning seed grain, so that the best and heaviest grain only may be employed for seeding. A novel feature is the combination with the trunk of a horizontal fan casing and air passages, said fan being arranged directly above said air trunk, so that its casing may serve to deflect and divide the ascending current, as set forth.

IMPROVED TRANSPLANTER AND FERTILIZER.

John H. Nolan and Benjamin Fitzpatrick, Chambers county, Ala.—The operation of this improved apparatus is as follows: The tube is filled with a fertilizing liquid, and a plant is placed on the ground. One handle is grasped by one hand and another handle by the other. The instrument is forced into the earth, carrying the plant with it by means of the hook. The rod is now drawn upward until the valve closes the tube and a second valve is opened, permitting a quantity of the fertilizer to escape. The valve is allowed to close when a handle is moved downward, forcing wings together, and carrying the earth around the plant.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED ELECTRO-MAGNETIC BOILER-FEED REGULATOR.

Richard A. Hays, Elgin, Ill.—This invention consists of a lever connected with a steam supply valve of a boiler-feed pump, or with a valve in the water supply pipe, and with the armature of two series of electro-magnets, the said magnets being connected with a relay, which directs the current through either series as may be required. When water is at the required level in the boiler, a float supports a spindle so that a guide touches a rod, completing the electrical circuit of the battery, exciting the relay magnet so that its armature is drawn toward it and into contact with the post. By this means a circuit is established, and the long arm of a lever is drawn toward a valve, which is thereby nearly closed, and remains so as long as the current is unchanged and the steam pump is only normally active. When the water drops in the boiler the float falls, and the current through the wires is broken, and the spring breaks the battery connection with the magnets and draws the long arm of the lever from the valve, opening the valve and admitting steam to the feed pump, which works with increased rapidity until the required water level is attained.

IMPROVED STEAM PLOW AND SCRAPING ATTACHMENT TO CARS.

Samuel T. Shankland, Laramie, Wyoming Territory.—This invention is an improved steam plowing and scraping attachment to cars, by which the plowing and scraping can be accomplished simultaneously with any number of plows or scrapers at both sides of the track, and thereby the work executed by the power of a locomotive with few hands. It consists of a car with a centrally pivoted plow crossbeam, having hinged scraper beam extensions. A second car, with sliding beams guided in side boxes of the first car, is moved forward and backward by a locomotive, and operates by chains attached to the ends of sliding beams and drawhead of the movable car, a number of scrapers to and from the track, to carry the dirt up to the track after the ground has been plowed by the direct action of the locomotive and plows of crossbeam.

IMPROVED CAR AXLE BOX.

Richard B. Eason, New York city, assignor to himself and Silas A. Allen, of same place.—This consists of a car axle box having a flanged oil chamber or receptacle with an exit spout coming in contact with the packing of the journal. The oil receptacle turns in bearings of the box, to bring the exit tube below a top opening for filling the same with oil. On turning it down again it is secured in position by a fastening bolt at the top passing through an extension flange of the receptacle.

IMPROVED SAND PUMP REEL.

William J. McKee, Petrolia, Pa.—This consists of the drive wheel of a sand pump reel, having rim, spokes, and hub in one piece, and provided with ears, rods, and nuts at the end of rods. By means of the nuts on the threaded portion of these rods the wheel may be drawn upon the tapering portion of the shaft as tightly as may be desired.

IMPROVED ALARM LOCK.

George W. Graham, Grand Junction, Tenn.—This invention consists of toothed bolts, moving at right angles to each other when engaged by a cogwheel turned by a key after the common spring bolt is withdrawn. The vertical bolt lifts the crossbar and rings a bell on opening.

IMPROVED PUMP.

Jeremiah F. Furnas and William W. Furnas, Dysart, Iowa.—This device may be used either as a force or lifting pump at pleasure. It is made to answer both purposes without stuffing boxes. The piston and cylinder are submerged, which renders it unnecessary to prime it, and obviates freezing.

IMPROVED SURGE RELIEVER FOR STEERING APPARATUS.

Robert M. Mountfort, Brunswick, Me.—This invention is intended to prevent the twisting off of the rudder from the rudderhead by the pressure or power of the waves dashing on the rudder; and it consists of cushioning devices attached to the tackle blocks at both sides of the rudderhead.

IMPROVED HOISTING AND CONVEYING APPARATUS.

Francis A. Clarkson, Black Brook, N. Y.—This apparatus for hoisting and conveying coal, casks, and other articles, is so constructed that it may be shifted laterally, as may be required. It embodies several new and ingenious devices calculated to add to its strength and efficiency, but which cannot be intelligibly explained without the aid of drawings.

IMPROVED MACHINE FOR PUNCHING AND SHEARING METAL.

Alfred Lee, Forest Grove, Oregon.—This invention consists of a toggle joint and two hand levers, and a peculiar arrangement of links for connecting the same, in combination with a punch and shears. By moving either or both of the levers the toggle joint is straightened, and the jaw moved downward with sufficient force to shear metal placed between the jaws, or to punch anything placed on the die in the recess in the standard.

IMPROVED NEEDLE CLAMP FOR SEWING MACHINES.

Joseph V. Morton, Winchester, Ky.—This invention consists in the arrangement of a clamping bolt, having a head for clamping the needle, and a shank that extends into a transverse hole bored in the lower end of the needle bar. It is notched to engage a wedge-shaped projection on a rod that extends upward in a hole bored longitudinally through the needle bar, and is capable of being drawn upward by a milled screw at the top of the needle bar, so as to draw the clamping bolt into the bar and clamp the needle.

IMPROVED BOILER.

Robert Excell, Chicago, Ill.—This is an improved boiler for heating greenhouses, etc. Arched pipes are provided, the lower ends of which are connected with holes in the lower parts of the inner wall of the boiler. The pipes pass up along the inner wall of the boiler, and their upper ends are connected with a larger pipe passing longitudinally along the crown arch of the inner wall of the boiler, and its forward end is connected with a circulator.

IMPROVED DEVICES FOR CUTTING AND PUNCHING SHEET METAL FOR CURVED PIPE ELBOWS.

Greene Choate, East Saginaw, Mich.—Two inventions. In the first the bed of the shears has a cutting edge which is formed on an ogee or reversed curve. Arms project from the bed, and to them the arms of the curved shear blade are pivoted. The curved shear blade is the counterpart of the curved cutting edge of the bed. Eyes project downward from the arms of the shear blade for receiving rods that connect the same with a foot lever. A spring is attached to one of the arms and bears against a projection for throwing the curved shear blade upward. A sheet of metal, having been punched by another machine, is placed upon the bed of the shears, with two of its perforations on registering pins, when the curved shear blade is forced down by means of a foot lever, and the sheet is severed along the line of the cutting edge.

The second device consists of a table having arranged across one of its ends a series of dies, a guide containing a gang of punches fitted to the dies, and a lever for driving the punches.

IMPROVED TILE MACHINE.

George S. Clark and William M. Pursell, of Piqua, O., assignors to said Clark and John O'Ferrall & Co., of same place.—This invention relates to the shaft and journal boxes of the machines; and it consists mainly in the combination of a square or polygonal shaft with collars that form the journals of the same, and with journal boxes and their supports.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CAR HEATER.

Edgar O. Huntington, Saginaw City, Mich., assignor to himself and Sanford S. Perkins, of same place.—This relates to that class of car heaters which are suspended below the bed frame of the car and charged from the outside of the same. It consists of a stove surrounded by a casing, to which air is supplied through side registers, to be heated up and transmitted, through drums with registers, to the interior of the car.

IMPROVED DRAFT EQUALIZER.

Levi W. Frederick, Hall, Ind.—This is a simple evener that may be used for two or more horses. It can be readily adjusted to distribute the load evenly between the horses, permits of the easy movement of each horse, and may readily be shifted to accommodate the required number of horses.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED SAFETY ATTACHMENT FOR POCKETBOOKS.

Thomas Ferguson, Parkersburg, Iowa.—This is an attachment for pocketbooks of all kinds, by which the same may be secured easily to the pocket lining in such a manner that it cannot be withdrawn except by first releasing the fastening device. It consists of a base plate attached to the pocketbook with a sliding pin that enters raised guard sockets of the base plate and attaches the pocketbook to the lining by being passed through the same.

IMPROVED FURNITURE SPRING.

John H. Dustan and Daniel W. Akin, Spartansburg, Pa.—This consists of a bed bottom consisting of longitudinal plate springs that have ends meeting, lapping, and fastened together subjacently, their continuity enabling them to sustain the spiral springs.

IMPROVED HORSESHOE.

José R. Cancio, Pol, Spain.—This horseshoe is applied to the hoof by means of a metallic band, of a suitable width and strength, which may be lined with leather or other material at the under side, so as to produce a tight frictional contact with the hoof. The shoe and band are connected with each other by front and lateral straps, which are riveted to the calks and secured by eyes and fastening screws at their upper ends to the band.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

J. H. T. and J. E. F. can calculate the sizes of change pulleys by the rule given on p. 138, vol. 34.—C. P. H. can fasten emery to steel by first painting the steel with white lead in linseed oil, letting it dry, and then coating with a thick solution of best glue.—S. W. will find directions for transferring engravings to wood on p. 138, vol. 30.—G. N. M. will find particulars of the screw threads on iron gas pipe on p. 378, vol. 32. As to galvanizing iron, see p. 315, vol. 36.—R. M.'s question as to well water for drinking and cooking purposes was answered on p. 268, vol. 36.—G. H. will find some information as to raising fish artificially on p. 17, vol. 29. He should address Mr. Seth Green, Rochester, N. Y., as to spawn, etc.—C. L. R. will find directions for making rubber stamps on p. 156, vol. 31.—J. T. L. should know the laws of his State better than we do.—A. F. will find advice as to chicken cholera on p. 395, vol. 30. —G. S. will find directions for making glue on p. 8, vol. 32.—A. K. will find an answer to his query as to drawing a circle touching three other circles on p. 377, vol. 34.—J. P. M. J. will find directions for making a storm glass on p. 75, vol. 30.—I. can cement rubber to brass by painting the brass with oil paint, letting it dry, and then gluing on the rubber.—W. M. M. will find a good recipe for harness blacking on p. 299, vol. 33.—H. H. R. can galvanize iron ferrules by the process described on p. 315, vol. 33.—M. S. F. and many others will find directions for constructing refrigerators on p. 251, vol. 31.—Will J. Y. B., who inquires as to practical locomotive engineering, send his name and address?—F. T. C. should read our articles on granite ironware on pp. 325, 340, vol. 36.—O. H. B. will find directions for skeletonizing leaves on p. 155, vol. 31.—E. will find advice as to corns on the feet on p. 202, vol. 34.—F. M. will find an article on staining wood on p. 323, vol. 36.—A. R. T. will find directions for constructing a filter on p. 251, vol. 31.—D. B. K. will find particulars of the Wisconsin reward, offered for a road engine, on p. 84, vol. 34.—H. S. will find a description of the motion of the wheels of a railroad car on a curve on p. 362, vol. 35.—J. R. G., J. F., H. L., C. H. F., S. W., A. K., J. P. L., N. F., J. R. B., S. S., J. B. O., N. W. K., J. C. B., C. G., J. G., O. M., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. B. says: For the benefit of J. K. W. (No. 21, June 9, 1877), I would say that water cannot be sucked through a pipe faster than the head (in this case the atmospheric pressure) will drive it; to attempt more will part the water rope, if we may so call it; and when the parting reaches the pump, the latter being relieved of its load, the whole working force of the steam will be expended upon the engine alone; hence the high velocity attained when the break has been effected. J. K. W may find, either by calculation or experiment, the velocity with which the water will travel through his suction pipe by the head which he now has; if that rate of travel does not supply him with sufficient water, the remedy lies in increasing the diameter of his suction pipe, and not in increased velocity. Cocks or valves will avail him nothing.

(2) J. B. says: The problem involved in No. 21, June 16, 1877, is fully covered by known physical laws. A stream of water acquires its velocity, be it more or less, in obedience to gravity, according to the sharpness of descent and the amount of resistance by friction on its bed. But the surface of a stream of water always has a pitch proportioned to the pitch of its bed. It would therefore be impossible for a log (or anything) to lie on its surface without being impelled by gravity from the higher to the lower part of its surface, just as a ball would travel from the higher to the lower end of a railroad car let loose and traveling down a steep grade. The headway such log will make over the stream must depend upon its fall and the amount of water it displaces in its travel. As there is the least amount of water displaced by the travel of the log when lying lengthways of the stream, and most when lying across the stream. The former position will give its quickest and the latter its slowest rate of travel, which correspond to the raftmen's assertion.

(3) H. W. P. says, in answer to A.'s query as to the speed of rafts in streams: It is because the friction on side and bottom of streams is so great that the center runs one third faster; and the deeper and heavier the raft, if it does not touch bottom, the faster it runs. In ordinary streams there are bayous to be filled by back water, which takes time; a raft also cuts across all bends in rivers, gaining time; and as soon as it strikes the center current again, it takes headway immediately. We used to run out lumber, etc., down a creek by holding the water in large dams, letting it off in a body. A boat starting ¾ of an hour after the dam was cut would overtake the first water in going 9 or 10 miles, that is, it would run ahead of the water so that it would stop in the middle of the stream and wait for water.

(4) R. C. W. asks: Will you please inform me how long cold can be kept up to freezing point by any chemical process without renewing the chemicals, and what chemicals are best for the purpose? A. Your question is somewhat indefinite. It should be borne in mind that cold, as we understand it, is occasioned simply by loss of heat. A body may be kept at a low temperature for an indefinite length of time, provided it be constantly surrounded with a body colder, or at least not warmer, than itself, or provided that it be protected from the possibility of acquiring heat from any source—either by radiation, conduction, or convection. The former is a comparatively easy matter to accomplish, but the latter is rendered difficult, if not impossible, by reason of the difficulty of realizing a perfect non-conductor of heat, and other essentials. In the change of matter from the solid to the liquid or gaseous condition, a definite quantity of heat disappears; and the more rapid this change, the more noticeable the loss of heat. In changing to a liquid, the solid ice may reduce the temperature of immediately surrounding bodies to nearly its own temperature (32° Fah.). If it be mixed in a fine powder with salt, the liquefaction is more rapid and the temperature may sink to 40° below the freezing point of water (8° below zero). Powdered ammonium nitrate, when mixed with just sufficient water at 40° Fah., to dissolve it, sinks the temperature to zero. Four ounces each of potassium nitrate (saltpeter) and ammonium chloride (sal ammoniac), when mixed with 8 ozs. water, will do the same. Finely powdered sodium sulphate (Glauber salt) drenched with strong hydrochloric acid will reduce the temperature 50° Fah., while a mixture of two parts dry snow or fine ice with three parts of powdered calcium chloride will freeze the mercury in the thermometer (mercury solidifies at 40° Fah.). The most intense cold is produced by the volatilization of liquefied gases, such as sulphurous acid, ammonia, nitrous oxide, and carbonic acid. By means of the latter a temperature of − 200° Fah. may be reached. As soon as the change is completed, the cooling action ceases, and of course the body will soon recover its normal temperature by acquisition of heat from the surrounding bodies, unless insulated by means capable of intercepting the heat—conditions which, at best, can be only imperfectly attained. Animal fibers, feathers, charcoal, asbestos, etc., are among the best non-conductors of heat, while polished metals and the like are the poorest radiators. Carré's method of refrigerating water by the promotion of its own evaporation (see p. 82, vol. 33) is perhaps the cheapest and most practical method—not excepting natural ice—for maintaining low temperatures for lengthened periods. On the quantity of material employed and the rate at which the liquefaction is permitted to proceed will depend on the length of time the low temperature may be maintained. This answer applies to several other queries.

(5) P. F. McC. asks: 1. How can sealing-wax be made so that it will set immediately on application, and not adhere to papers coming in contact with it soon after being applied to the matter to be sealed? A. Wax which contains a larger proportion of shellac and less of Venice turpentine hardens more quickly. Try incorporating with it a little more powdered shellac by fusion. 2. Can I use anything else that will adhere as tenaciously as sealing-wax? A. Perhaps a stick of shellac alone would answer the purpose.

(6) S. R. says: 1. I have had used on cuts, scratches, sores, etc., on dumb beasts, zinc variously prepared from chloride, oxide, iodide, phosphate, etc., but I fail to get it prepared so as to be lasting. A solution is soon gone, an ointment lasts but a little longer. A. Do you mean metallic zinc, its oxide, or the salts? Zinc and its inorganic preparations are all lasting. Perhaps we do not get your idea. If you mean that when applied they soon rub or wash off, perhaps forming them into an emulsion with pure gelatin and a little glycerin would obviate the difficulty. 2. In what way can I put a foil or coating, or some other preparation of zinc, on leather so as to have it remain permanent, and so that the leather will remain soft and pliable? A. You can use a thin solution of caoutchouc in coal tar naphtha as a cement.

(7) S. W. asks: How can I make a flexible spirit varnish with such tenacity and pliability as not to be influenced by atmospheric changes? It is intended for finishing leather. A. What is known as spirit copal varnish will best serve your purpose. You will find it described on pp. 59 and 91, vol. 36. We do not know of another spirit varnish that will answer.

(8) F. B. N., and others who ask for a good walnut stain: Boil 1 quart water and add first 1½ ozs. washing soda, and then, a little at a time, 2½ ozs. of Vandyke brown. When the foaming has nearly ceased, add ¼ oz. bichromate of potassa dissolved in a little boiling water; stir well and filter through a cloth. The color may be deepened with a drop or two of Brunswick black, or made of a warmer tone by increasing the amount of water and adding more bichromate of potassa. It should be applied with a brush quickly, and without much lapping; and when dry it takes a good coat of varnish.

(9) E. E. W. asks: How can I make torpedoes such as the boys use on July 4? A. A little fulminate of mercury is the material commonly used, also powdered chlorate of potassa and sulphur. To prepare the fulminate, 1 oz. mercury is dissolved, with the aid of a gentle heat, in 8½ ozs. by measure of nitric acid of specific gravity 1·4, and the solution is poured into 10 measured ozs. alcohol, specific gravity 0·83; action soon ensues, with the evolution of copious white fumes, and the fulminate is deposited in white crystalline grains, which are washed with very cold water and dried at a very gentle heat. The greatest care should be observed in preparing this material, as it explodes with extreme violence when overheated as well as by slight percussion or friction.

(10) A. P. asks: Why is a fillet left in the corner of an axle bearing? A friend claims that the fillet is left on bearing to prevent wear of brasses. I claim that it is left to strengthen axle. A. The fillet is left to strengthen the axle.

(11) S. H. W. asks: 1. How can I make a kaleidoscope? Should the reflecting strips of glass be of uniform width throughout their length, or should they be wider at one end than at the other? A. With ordinary illumination the reflectors may be parallel; but it is better to set them at an angle. The longer the tube the smaller the angle. In a tube 9 inches long, this should be about 8°, allowing ¾ inch diameter for the eye aperture. 2. Is it necessary that the glass should be silvered? A. No; use a black backing, so as to leave only only one reflecting surface. 3. How and where should the bits of colored glass be arranged to get the prettiest effect? A. Use a few small, brightly colored, angular, and prismatic pieces of glass, a few small glass tubes containing several drops of colored liquids, and, if the figure is desired to contain curve lines, a few pieces of curved tubing (with or without liquid), and some colored beads. Place these loosely between two pieces of clear glass in a suitable cap, somewhat larger than the opening between the reflectors, and adjust the cap on the large end of the tube so that the light will pass through it. Too much shifting material in the cap will cause the figure to change sluggishly and imperfectly. The space between the glasses in the cap depends somewhat on the size of the glass tubing used, but should not much exceed half an inch.

(12) W. E. B. asks: 1. How can an inexperienced person finish a cane made from cabbage palmetto wood? A. Fill the pores with common oil rosin varnish, and when dry, rub down with fine sandpaper or pumicestone. Then apply a flowing coat of spirit copal or French varnish. 2. Is this finish applicable to orange canes, with the bark on? A. The orange sticks should be smooth and dry. Use a filling of alcoholic shellac, and finish as above.

(13) J. W. S. asks: Can you give me directions for making cupro-ammonium? A. Cupro-ammonium or ammonio-cupric oxide is perhaps most readily obtained by precipitating a strong aqueous solution of sulphate of copper by the addition of ammonia water, filtering off the liquid and dissolving the precipitate in a slight excess of strong ammonia water. If an excess of the ammonia be used in precipitating the copper oxide it will redissolve the precipitate. To be used as a reagent, the cupro-ammonium solution must be concentrated by evaporation.

Is there any substance that will dissolve, not decompose, silk or wool? A. No.

(14) A. A. W. says: Desiring to make a waterproof cloth more reliable for rough usage than rubber, I saturated some cotton goods with linseed oil boiling hot, but failed to make a good waterproof. Can you give me a recipe for making such goods? A. Dissolve in the oil about five per cent of beeswax, and pass through this the cloth previously saturated with a strong solution of acetate of lead and dried perfectly. Instead of dipping the cloth, the oil is often applied with a brush. Alum solution is sometimes used instead of the lead salt.

(15) J. B. H. asks: What is the best method of treating quicksilver, used for amalgamating purposes, in a quartz crushing mill? The base metals in connection with the gold are metallic arsenic, manganese, sulphur, iron pyrites, and white and yellow mundic. A. If we understand you, the best way would be to drive off the sulphur, arsenic, etc., by roasting the crushed ore before introducing it to the amalgamating tubs. The mercury is recovered by distillation from the amalgam in an iron retort, and condensing the mercury vapor in cold water. If the mercury is contaminated with sulphur and arsenic compounds, it may be freed from these by mixing it with a quantity of lime and heating in a close iron retort to about 400° Fah., which drives off the arsenic, and then transferring to a clean retort and distilling off the mercury at a much higher temperature (662° Fah.).

(16) T. says: Some tarletan which I carefully put away last year I find to be full of holes, as though eaten by moths. What insect do you think would eat tarletan? A. Tarletan, which is often dyed with colors requiring an animalization of the fibers (that is, a treatment with gelatin, etc.) in mordanting, is much subject to the depredations of the moth. 2. Of what is tarletan made? It does not appear to be cotton. A. Tarletan is a cotton fabric.

(17) F. W. M. asks: 1. Is a zincograph printed from a perfectly flat surface, as a lithograph is, or is etching necessary in preparing the plate? A. The plate is slightly etched with dilute nitric acid after the drawing is made. 2. If printed from a flat surface, how is the design put upon the plate, and how is it made to adhere? A. In photo-zincography, a flat surface is used. The image on chromate of gelatin paper is washed, inked by passing the ink roller over it, and the lines in fatty ink transferred to the plate by carefully pressing the paper on it. The ink lines adhere to the metal as they do to the stone. 3. Do you know of any substance which will render soluble the bichromate of potash and gelatin waterproofing on paper, without injuring the fiber of the paper? A. This is accomplished, although imperfectly, by alkaline washes.

(18) W. A. V. N. asks: Is there any formula by which I can determine the pressure of steam per square inch in a vessel used to generate steam, but which we regulate by a thermometer, there being no steam gauge attached? A. If your thermometer is so arranged that it gives you the temperature of the steam, you can determine the pressure by reference to a table, or you can calculate it from the formula given on p. 81, vol. 29.

(19) W. B. B. asks: Which will run more easily up hill, a small wheel or a large wheel, on a smooth surface? A. A large one.

(20) B. J. T. says: Some of the ball players say they can throw a ball on a curve to deceive the striker. Some say they can throw the ball in almost a direct line; and as it nears the striker it will diverge, taking a short curve. Is it possible to throw a ball in this manner? A. We have often watched skillful pitchers, but never have seen the action spoken of, and would require something more than mere assertion to make us believe it.

(21) E. J. W. asks: What is the cracking which is frequently heard in steam radiators? A. It is generally due to imperfect circulation, and the presence of air in the pipes.

(22) J. M. says: A party here claims that a boat will draw or sink deeper where the water is shallow than in deep water. Also that it will draw less in the night than in the daytime. I deny the above assertions. A. We think you can do so safely.

(23) G. G. asks: Is the trisection of an angle impossible? If so, why? A. Brande states "that the indefinite trisection of an angle cannot be effected by plane geometry, that is, by means of the straight line and circle, inasmuch as the analytical equation on which it depends rises to the third degree."

(24) W. H. C. says: I wish to build an hydraulic engine, with a cylinder 10 inches in diameter by 12 inches stroke, using a pressure averaging 20 lbs. How many foot pounds would it raise, provided the engine attained a velocity of 100 revolutions per minute? A. Horse power = (pressure per square inch on piston × area of piston in square inches × speed of piston in feet per minute) ÷ 33,000. From this you will see that the power varies directly as the pressure.

(25) H. F. says: I have in one solution sulphate of quinia, sulphate of iron, and phosphoric acid.

How may each be obtained separately? A. If there is nothing else in solution with these, the following method may be employed: concentrate the solution and precipitate together the alkaloid quinia and the iron as ferrous oxide, by the addition of a sufficient quantity of solution of caustic soda, and filter. Wash the precipitate with spirit of wine in which the alkaloid and adhering alkali (soda) are both soluble. Dry the oxide of iron thus freed from the quinia, dissolve it in the least quantity of dilute sulphuric acid, with the aid of heat, and crystallize out the sulphate by evaporation. Evaporate the alcoholic solution carefully to dryness, and wash out the soda quickly with a little cold water, in which the quinia is scarcely soluble. Dissolve the purified quinia in a small quantity of sufficiently dilute sulphuric acid, and crystallize out the sulphate by evaporation. Add to the solution containing the phosphoric acid as ortho-phosphate of soda together with sulphate of soda, solution of barium chloride, until no further precipitate forms. Filter, wash the precipitate with plenty of water, digest it for a short time with a little strong, warm nitric acid to dissolve out the basic phosphate, and filter from the accompanying insoluble basic sulphate. Then stir into the solution, a drop at a time, strong sulphuric acid until a precipitate no longer forms. Filter the solution and crystallize out the phosphoric acid by evaporation.

(26) J. C. says: I have an engine of 2 inches bore and 4 inches stroke, the boiler of which is 40 inches high and 20 inches in diameter, with twelve 1 inch tubes. Boiler is bolted to a cast iron firebox, 20x20 inches. Could I use said engine on a boat 15 feet long and of 4 feet beam, with a three-bladed propeller 30 inches in diameter, and attain the speed of six miles an hour, the engine running at 200 revolutions a minute? A. The machinery will probably answer; but we think it might be better to use a smaller screw.

(27) E. O. asks: What is meant by a balanced valve of a steam engine? A. A valve that is relieved of the excess of pressure in its back.

(28) L. S. C. says: 1. I have an oscillating engine, cylinder 2½x4 inches, steam pressure 100 lbs., revolutions 325; and also a boat 18 feet 6 inches long, drawing 22 inches water when loaded light. Can I use a screw of small pitch, and couple direct from engine, or must I reduce speed by gearing? A. You can couple directly to the screw. 2. If coupled direct, what should the pitch be? A. Pitch from 2½ to 3 feet.

(29) E. A. C. asks: What is the proper proportion of length to breadth in the American flag? A. Flag makers say that it should be as 3 to 5. A flag 10 feet long should be 6 feet wide. There should be 13 stripes (7 red and 6 white) and 38 stars. The blue ground should extend down to the sixth stripe, and in length should be proportioned to that of the flag.

(30) J. T. says: Please give the proper angle that a groove in a pulley should have to be suitable for a round band? A. It is considered good practice to make the groove with a curved section, having greater depth than width, so that the belt will not bottom as it wears.

(31) N. S. says: We are told that, when a top is spinning in an inclined position, it is its centrifugal force which holds it up and keeps it from falling. Please explain this: In a perfect top, one in which the quantity of matter is equally distributed on all sides of its axis, is not the centrifugal force on all sides equal? Hence, does not the centrifugal force operate just as much in favor of gravitation as against it? Where, then, is there any balance of centrifugal force to counteract the attraction of gravitation? A. Quackenbos says, in his "Natural Philosophy": "The center of gravity is not over the point of support all the time the top is spinning, but is constantly moving round the axis of motion, and, before the top can fall, in consequence of its being on one side of the axis, it reaches the other side, and thus counteracts the previous impulse. Hence, the faster the top revolves, the steadier it is; as its motion slackens, it gradually reels more and more, and finally falls."

(32) W. T. says: I have a steam yacht of the following dimensions: Keel 18 feet 6 inches long, breadth 6 feet 3 inches, least depth 2 feet 5 inches. The engine is 3¼x4½ inches, and the propeller is of 22 inches diameter and 3 feet 6 inches pitch. With 75 lbs. steam, the speed of the boat is satisfactory; but the engine runs at a speed so high that I fear it will wear out fast. Could not I put on a larger propeller and obtain the same or a greater speed of the boat? If so, what style and diameter had I better try? There is sufficient clearance to put in a 24 inch propeller without altering anything about the boat. A. The data sent are so incomplete that we do not feel able to offer you much advice. We see no particular objection, however, to the use of a screw 24 inches in diameter, with a slight increase in pitch.

(33) W. J. M. says: Our water reservoir is located about 1 mile from my office at an elevation of about 140 feet. I want to locate a gauge in my office which will show the depth of water in the reservoir. I arranged a column of mercury 11½ feet long; but when the water was turned on the mercury was forced out in a jet a foot above the top. I estimated that 140 feet would give a pressure of about 61¼ lbs., which would sustain a column of mercury only about 123 inches. What is wrong about it? A. If you have estimated the height correctly, we imagine the trouble was caused by opening the cock suddenly, or perhaps you did not have enough mercury in the tube. It seems to be high enough under the conditions stated.

(34) B. & W. ask: How can we deodorize benzine? A. Properly speaking, benzine cannot be deodorized. Much, however, of the disagreeable odor of commercial benzine may be removed by redistilling it with a quantity of good lime, and rejecting the first and last portions of the distillates.

(35) F. B. S. says: I have a refrigerator with wooden shelves, which, by standing in a damp cellar during the winter, has become tainted to such an extent that it affects food placed in it. How can I cleanse it? A. Rub the parts over well with a strong solution of chloride of lime (calcium hypochlorite); and after letting stand a short time, rinse first with water containing a little carbonate of soda, and then with plenty of clean water. Dry, and expose to the air and sunlight, if possible.

(36) J. K. asks: 1. How many years will wrought iron water pipe, plain, with ¾ inch internal diameter and ⅛ inch shell, last if buried underground in clay say 20 inches deep? A. If the water is pure, it may last from 10 to 15 years. 2. Is galvanized iron pipe as good as tin lined lead pipe as far as health is concerned for conveying water for general house use? A. No. See p. 244, vol. 36.

(37) V. says: A. asserts that, by placing the large wheels in front and the small ones behind on a carriage, it will be running up hill. B. says it will not. What is the difference? A. As the axles are generally arranged, the disposition of the wheels would make the front of the wagon the highest, but it would not necessarily act as when running up hill.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Blue Glass. By J. M.
On Locusts. By H. J. L.
On Accidents to Mechanics. By G. S. W.
On a Nervo-Mental Force. By J. R. D.
On the Carolina Lizard. By C. F. S.
On Canceling Postage Stamps. By W. K. P.
On a Torpedo Feeler. By F.
On the Occult Sciences. By J. B.

Also inquiries and answers from the following:
W. E.—S. R. H.—D. W. W.—D. S. F.—H. F.—H. M.—C. F. S.—J. K. B.—J. F. L.—P. J. W.—C. B. J.—F. B.—C. R.—N. T. W.—A. K.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best filter for domestic use? Whose is the best oil stove? Who makes a three-way machine for cutting threads on wrought iron pipe? Who makes malleable iron castings? Who sells the best screw-cutting tools? Whose is the best steam pressure gauge? Who makes the best steam whistles?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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10,012.—CARPET.—J. Campbell, London, England.
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10,023, 10,024.—MONUMENT.—J. Morgan, Brooklyn, N. Y.
10,025.—BILLIARD TABLES.—C. Schulenburg, Detroit, Mich.
10,026.—BRACELET.—M. Sternheimer, New York city.
10,027.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.
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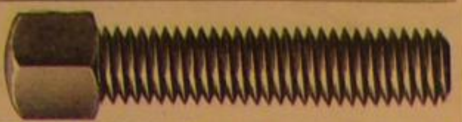

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