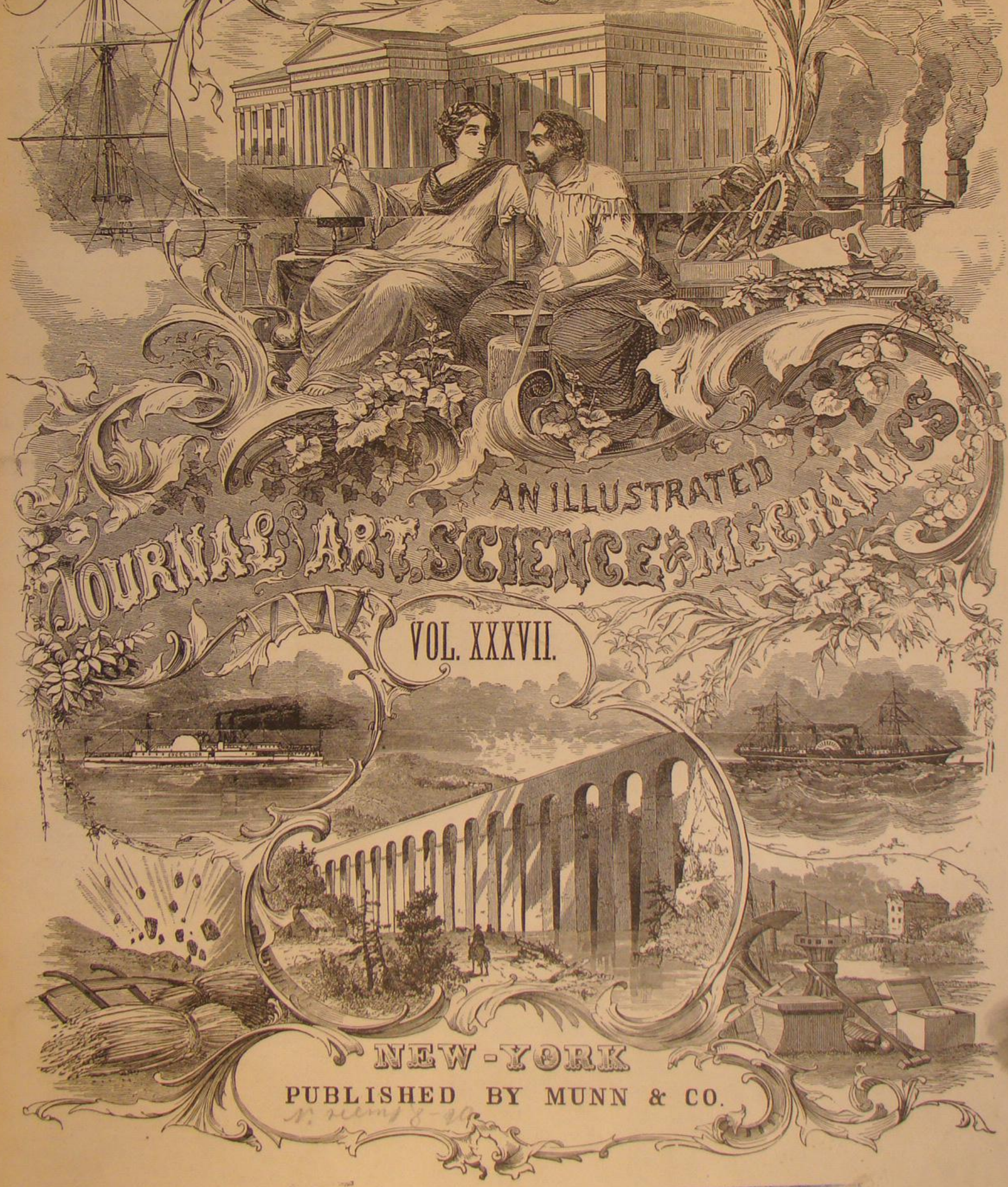
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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVII.—No. 1. [NEW SERIES.] NEW YORK, JULY 7, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

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.

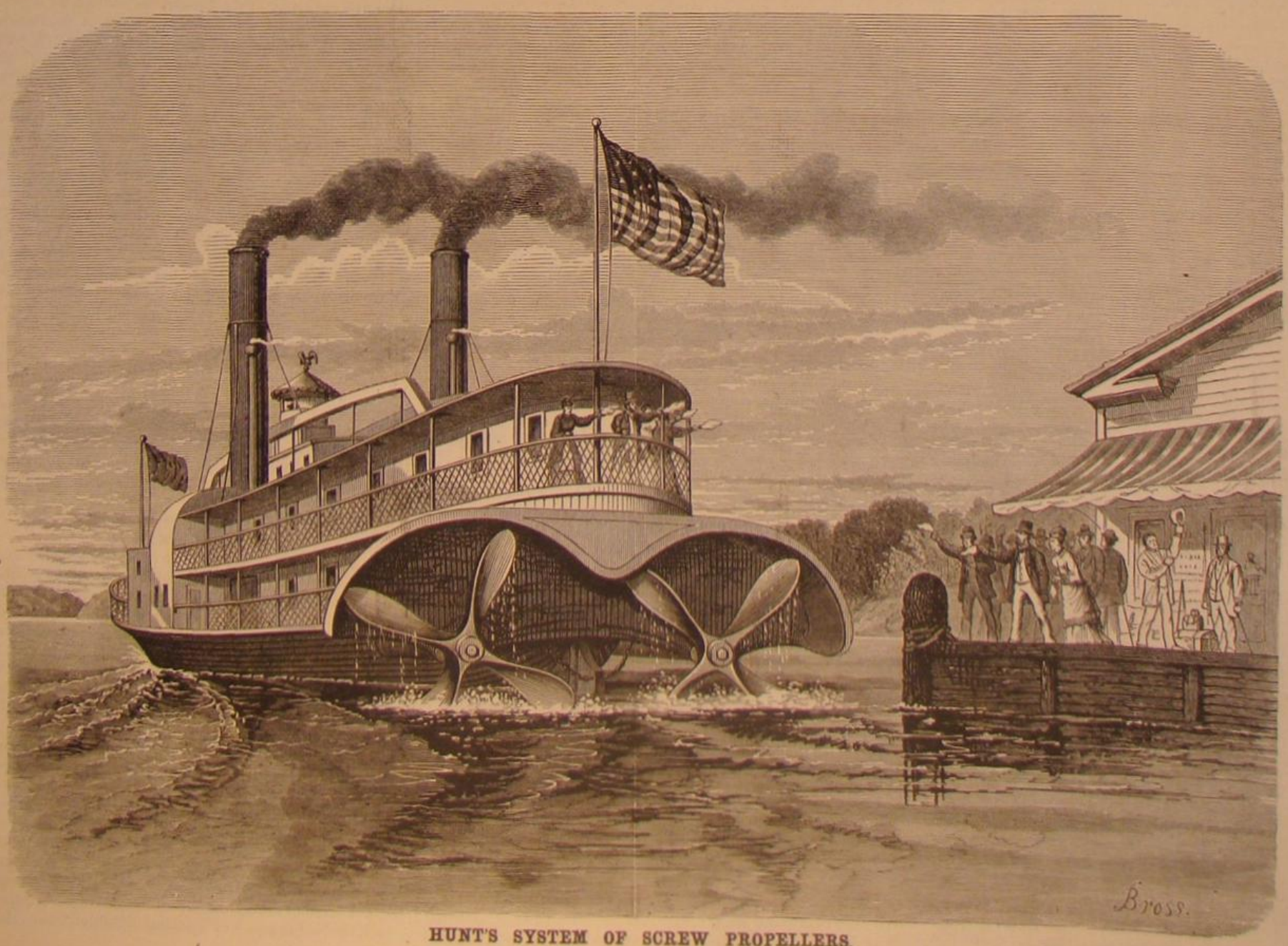
Cast iron containing carbon and other substances, such as manganese, silicon, or other alloy, is now added to fluid iron and steel, by which carbon is added to them. The amount of carbon in cast iron being limited, a large proportion of cast iron must be added, if much addition of carbon be required, 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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NEW YORK, SATURDAY, JULY 7, 1877.

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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.

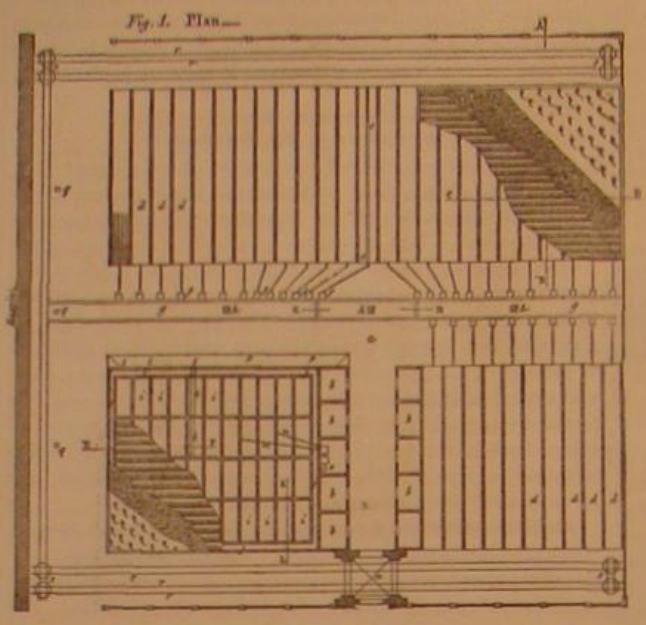
A NEW SYSTEM OF PETROLEUM STORAGE.

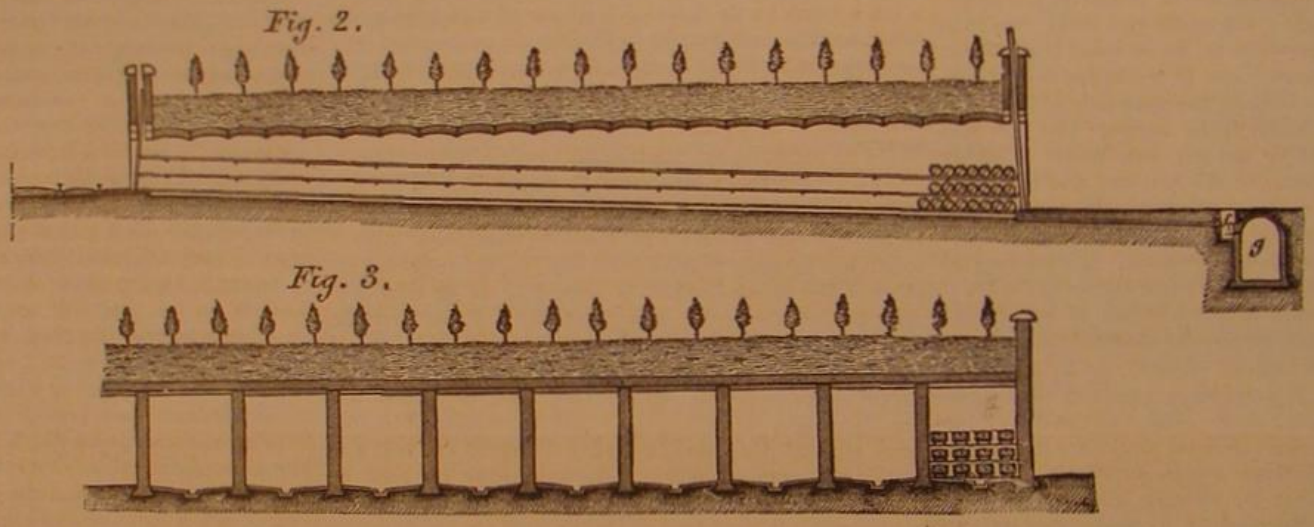
Fires in petroleum tanks are accidents of common occurrence, and the loss therefrom yearly aggregates heavy sums. Leakage and evaporation are other sources of waste, which aid in reducing the profits gained between producer and consumer, or which, in other words, tend to increase the price which the 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.

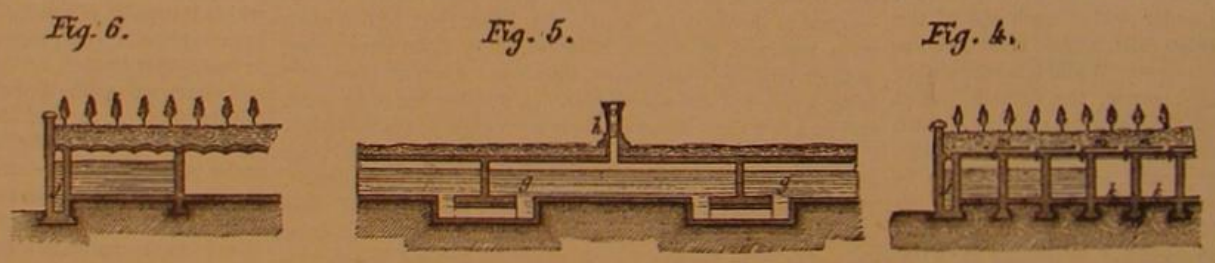
M. Donny's project comprises two distinct parts. One is destined to receive petroleum directly from the pipes or from vessels in bulk; the other, to afford proper receptacles after the oil is in casks. The system of bulk storage is represented in plan and in horizontal section on the lower part, left 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.

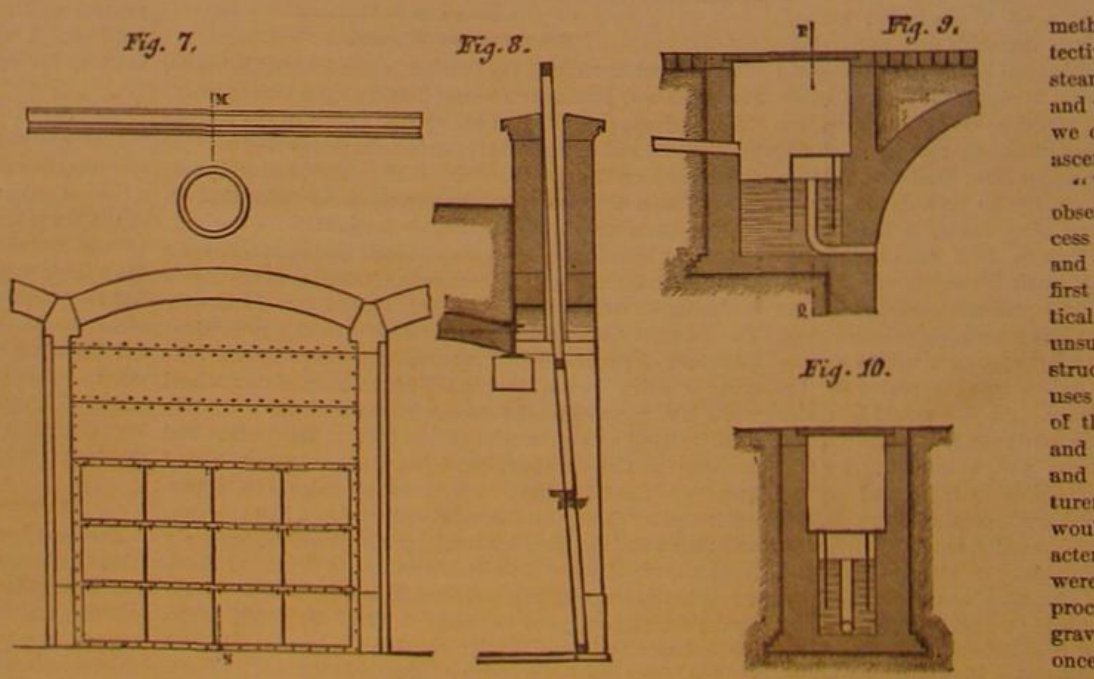
The storage arrangements for petroleum in barrels are represented in plan in the upper part of Fig. 1. Figs. 2 and 3 show longitudinal and transverse sections on the lines, A B and C D, in Fig. 1, and Figs. 5, 7, 8, 9, and 10 exhibit the principal details of the system. The magazines, *d*, are of masonry, 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*.









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 demon-

strated 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.

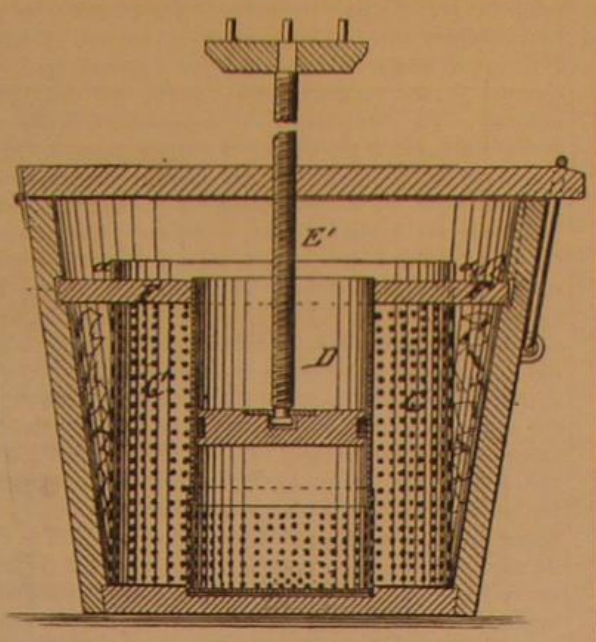
Few of the persons who handle Bank of England notes ever think of the amount of labor and ingenuity that is expended on their production. These notes are made from pure white linen cuttings only, never from rags that have been worn. They have been manufactured for nearly 200 years at the same spot—Laverstoke, 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.

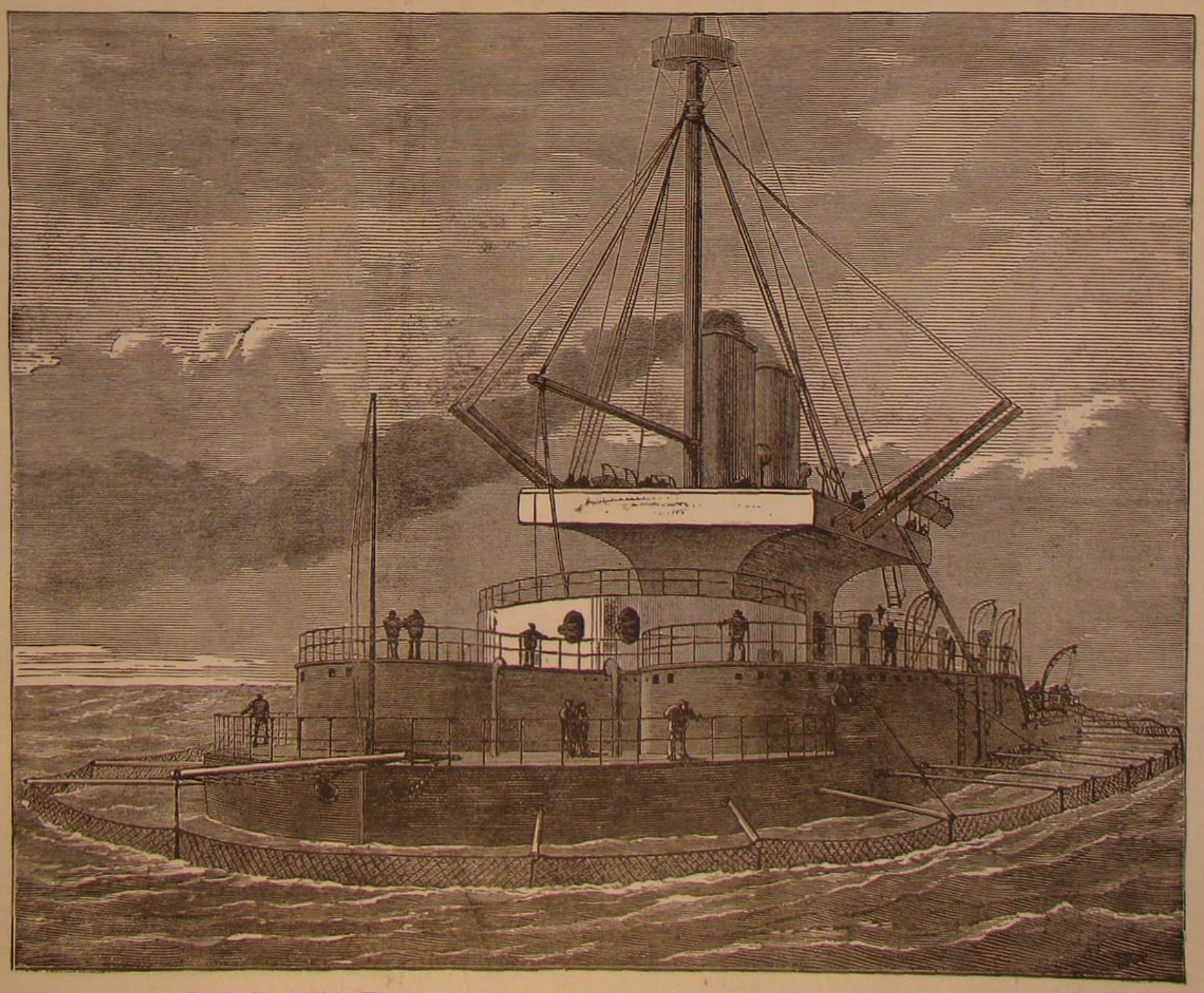
When the tub is used for work it is filled with water, which is cooled by the ice placed between screen and tub. The cold water rises to the same level in the interior cylinder as in the outer screen, the butter being placed into the cylinder and forced down by the action of the follower, lowered by 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.

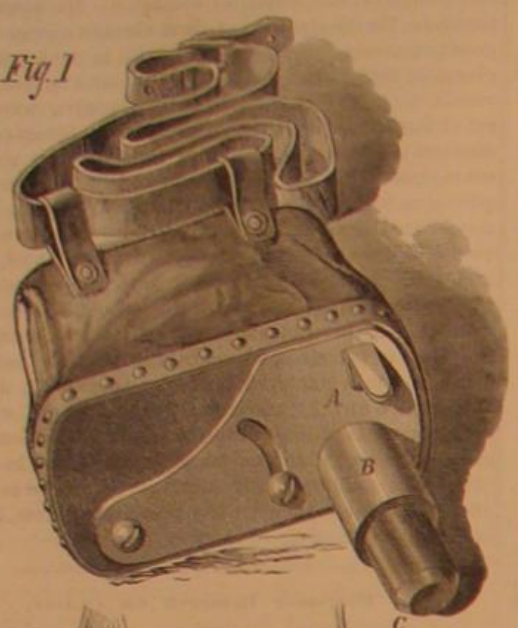


A BRITISH MAN-OF-WAR PROTECTED AGAINST TORPEDOES BY NETTINGS.—(See page 8.)

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

Fig. 1



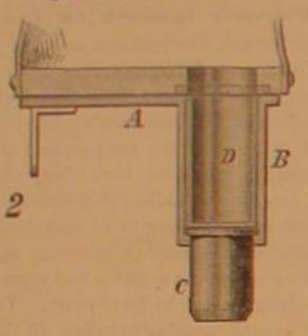


Fig. 2

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.

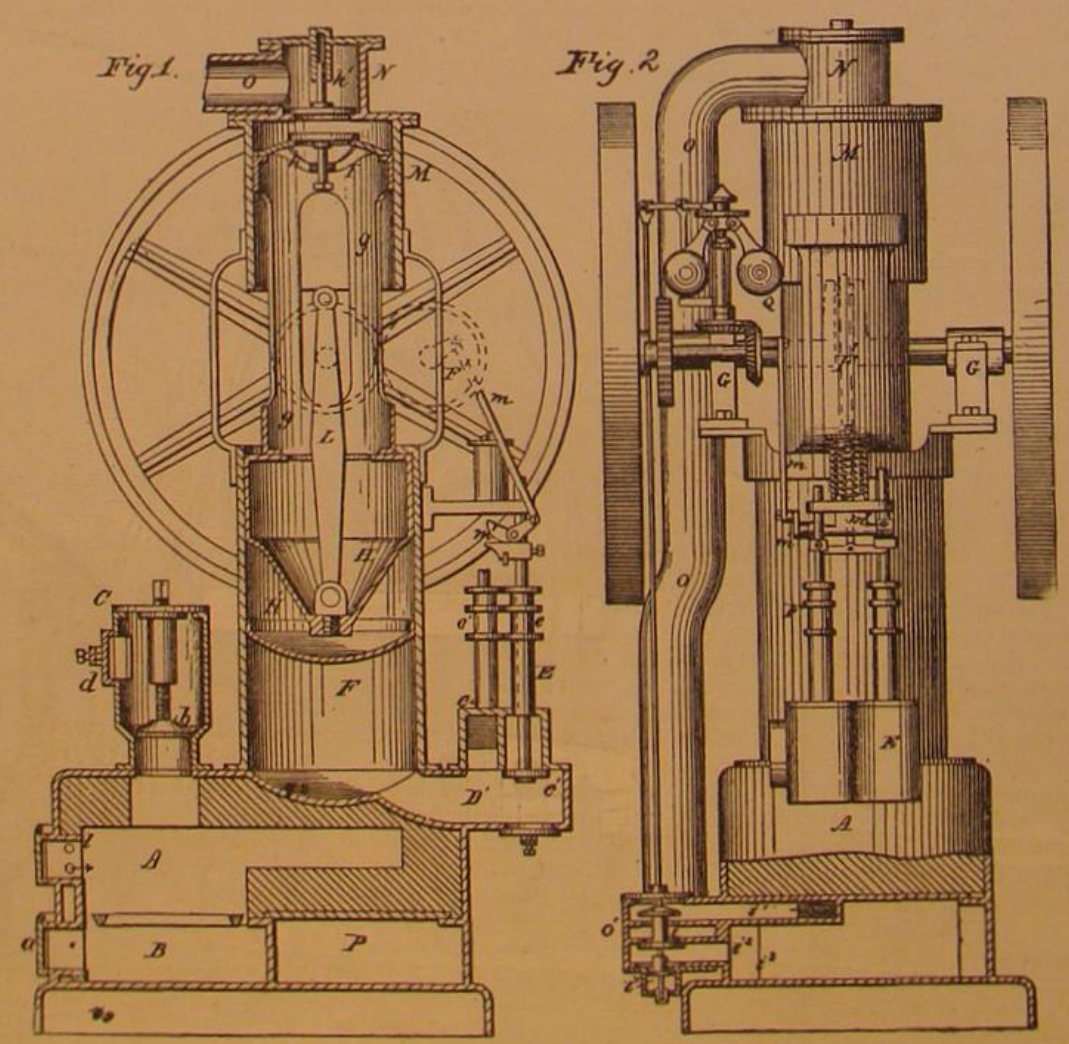
It will be clear from Fig. 2 that, in the position shown of the parts, the shot will descend through the aperture in the bottom and fill the charger. The pivot plate, A, is then moved so as to bring the tube clear of the bag; and at the same time it keeps the bottom aperture closed. By pushing upon the 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.

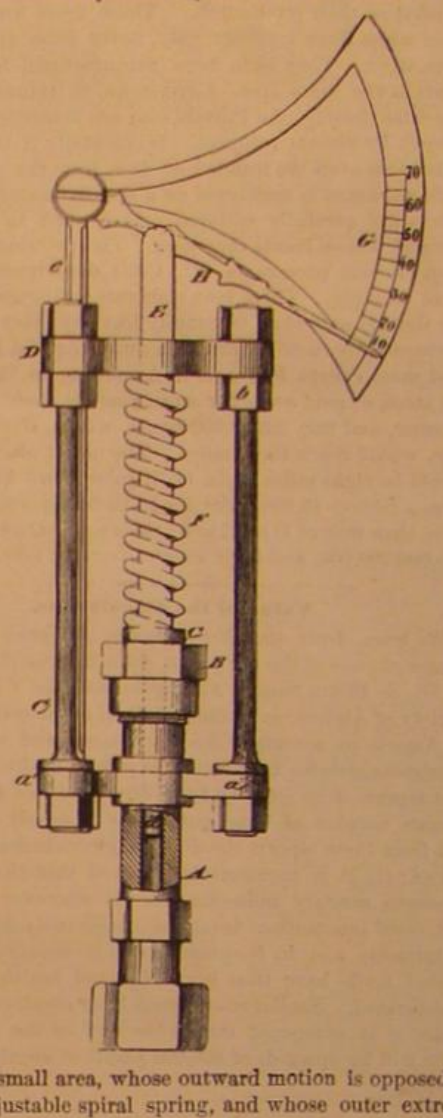
Fig. 1 represents a vertical longitudinal section of the motor, and Fig. 2 is an end elevation. A represents the cast iron furnace that forms the base section. Concentrically above the circular grate is arranged a box, C, whose contracted throat is closed by a valve, *b*, that is raised or lowered to 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^2, directly with the grate, and by a lower opening, i^3, 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 gove. nor 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*.

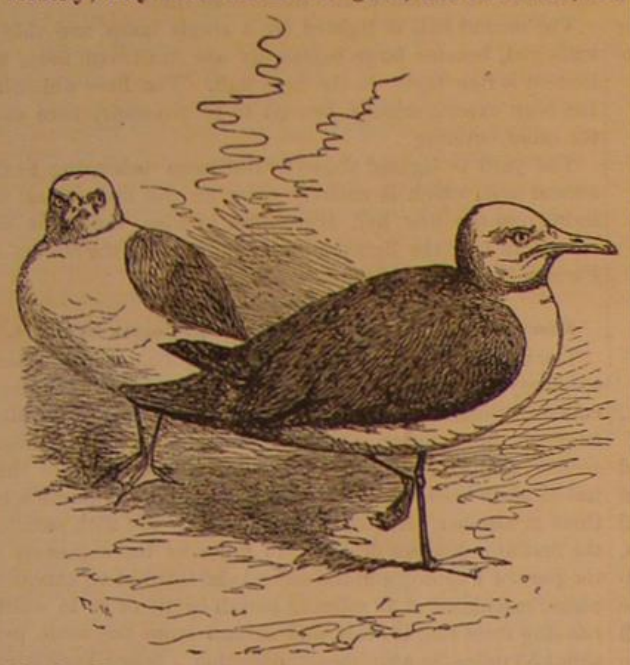
Patented through the Scientific American Patent Agency, May 15, 1877, by Mr. W. T. Snyder, of Catasauqua, Pa.

TO TIN ZINC.—Make a bath of distilled water 1 gallon, pyrophosphate of soda 3½ ozs., fused protochloride of tin ½ 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.*

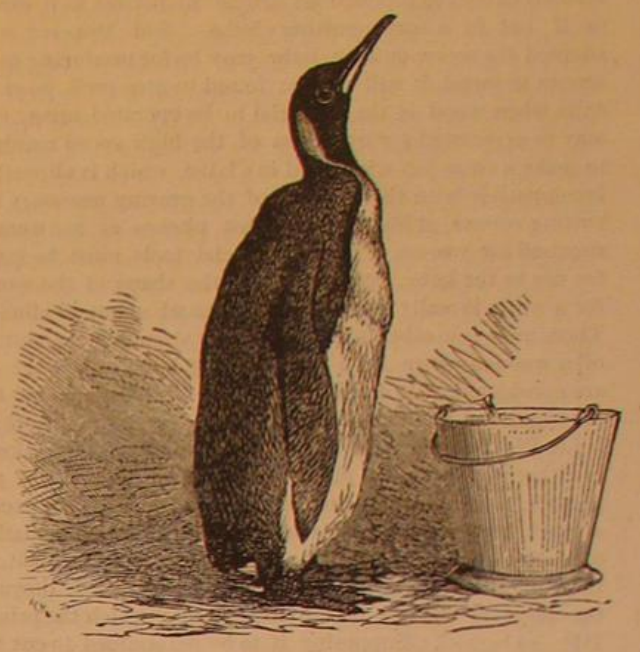
THE FOUNTAINS AT ARANJUEZ.

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.

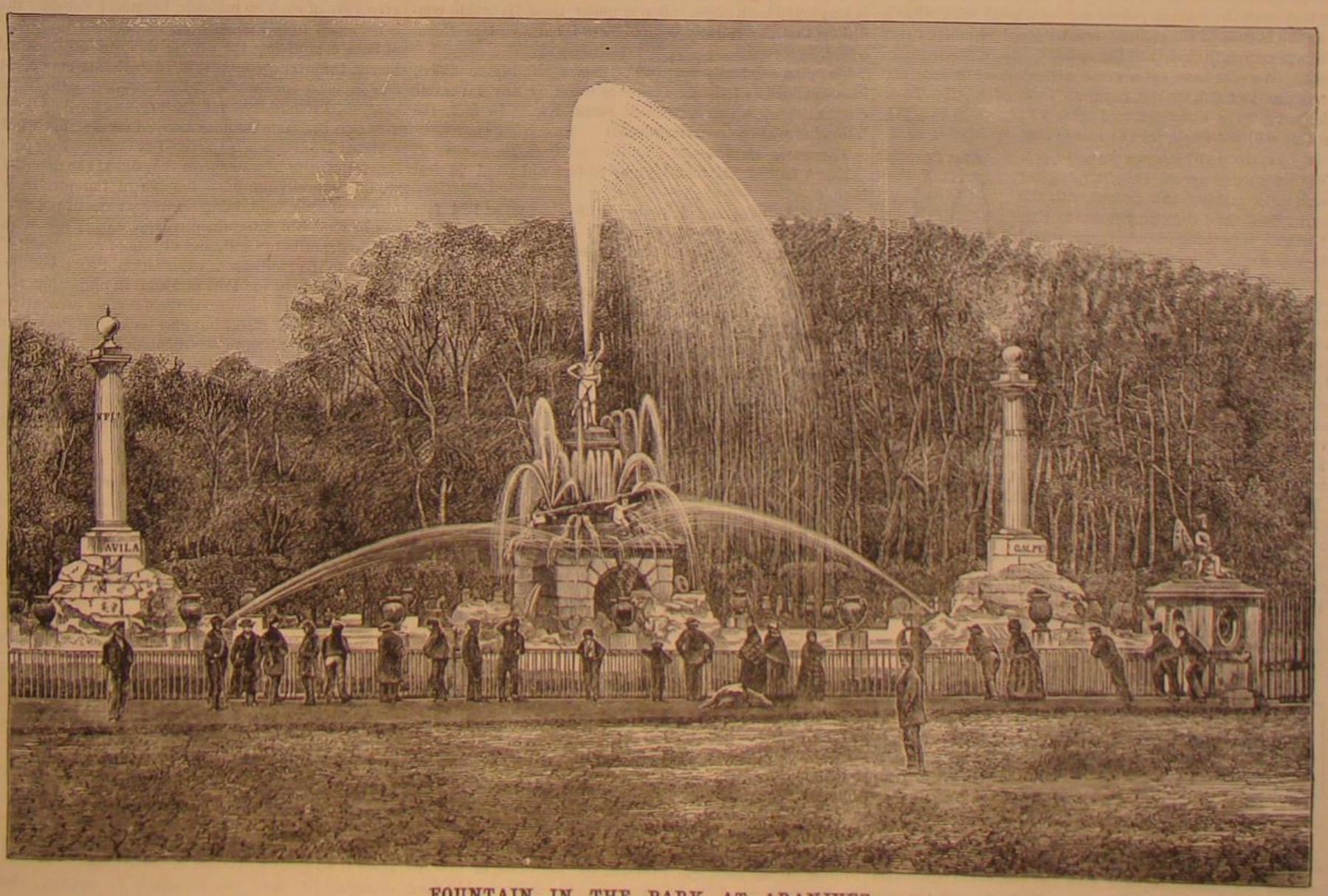
Of the numerous family of web-footed, imperfectly winged birds, the king penguin (*aptenodytes Pennantii*) may be taken as a specimen. The whole genus is characterized by the slender bill, with an acute tip, by the close-set plumes on the upper mandible of the bill, and by the fin-like wings, which are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

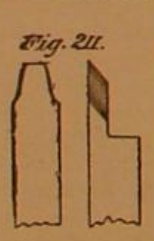


Fig. 210.



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.

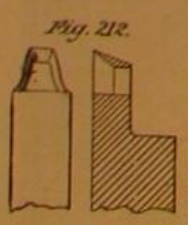
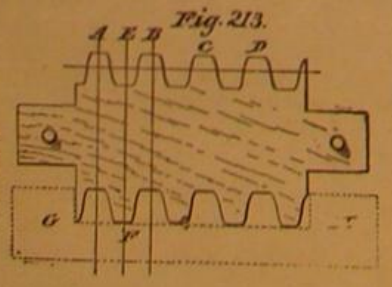


Fig. 213.



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 temporarily 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.

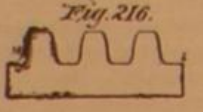
Fig. 214.



Fig. 215



Fig. 216.



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 $1,206,506—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 cog-wheel 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.

How to make Violins—Write J. Ranger, Syracuse, N.Y.

State and County Rights for Sale.—Wilkinson's Liquid Measure. See illustration on page 374 last volume of the SCIENTIFIC AMERICAN. Patented in the United States and Canada. Address J. W. Wilkinson, P. O. box 1301, Meadville, Pa.

Walrus Leather and fine Wool Polishing Wheels; all sizes. Greene, Tweed & Co., 18 Park place, N. Y.

Bookbinder's Stock Cutting Machine. Send for Circular. Frank Thomas & Co., Home St., Cincinnati, O.

A rare opportunity for a good practical man.—On accomodating terms a one half or whole interest in Machine and Repair Shop. J. A. Campbell, Farmington, Iowa.

Manufacturers of friction clutches, please send cuts and prices to Wiles, Adams & Co., 13 and 15 Union street, Troy, N. Y.

A Good Chance.—$2,500 will buy right of Talley's Liquid Vent and Automatic Bung Vent. J. Talley, Kansas City, Mo.

Three plain Cylinder Boilers, 34 in. by 35 ft.; Domes, 24 x 24 inches; in good condition; very cheap. Wilson & Roake, 251 Front street, New York.

New and Improved Butt Machinery. Patterns and Fixtures for sale for making Cast Iron Butts. Will be sold at a great bargain. Address, Box 123, Phillipsburg, N. J.

34" x 17 ft. Lathe, $400; 16" do., $175; 15" do., $150. 4 ft. Planer, $275. 1½" Drill, $150. At Shearman's, 132 N. 3d St., Philadelphia, Pa.

For Engine Lathes and Iron Planers, send for Illustrated Catalogue and Price List to Ames Manfg. Co., Chicopee, Mass.

Small Fine Gray Iron Castings a specialty. Soft and true to patterns. A. Winterburn, 16 De Witt St., Albany, N. Y.

Linen Safety Hose, all sizes, at lowest rates. Greene, Tweed & Co., 18 Park place, N. Y.

Wanted—Second-hand 12 in. Lathe. Address, 101 Laramie City, Wyoming Territory.

Wanted—A complete machine to make Wire Hair Pins. Reply to T. J. Goff, West Oakland P. O., Cal.

For Sale Cheap.—Two Patents. Combined Tea Kettle and Steamer, and combined Foot Scraper and Wiper. Address J. A. Worley, Cleveland, O.

West's New Yankee Tire Setter. Sets them cold on the wheel. Shrinks all around alike. J. B. West, Rochester, N. Y.

For Sale.—One Spinning Lathe. Good as new. Address White Sewing Machine Co., Cleveland, O.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

Shaw's Noise-Quieting Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R. I.

For Sale.—Second-hand 4 Sided-Moulder, with about 300 knives; good as new; price $500. T. R. Bailey, Agt., Lockport, N. Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N. Y.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 43 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

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Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

All nervous, exhausting, and painful diseases speedily yield to the curative influences of Pulvermacher's Electric Belts and Bands. They are safe and effective. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

Territory, on a Useful Household Article, given away free. Address Ezra F. Landis, Lancaster, Pa.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 14.

Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

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 bayons 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 2¼x4 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 15 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 61½ 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. 944, 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.

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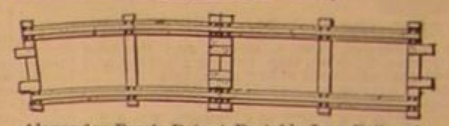
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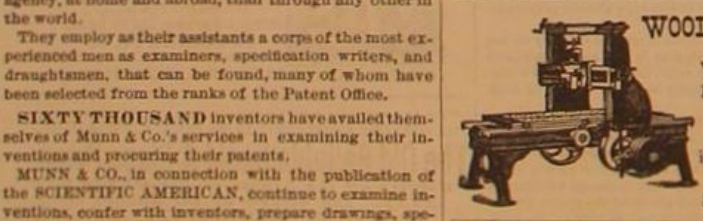
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Vol. XXXVII.—No. 2. [NEW SERIES.] NEW YORK, JULY 14, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

BOWER'S PATENT AIR COMPRESSOR.

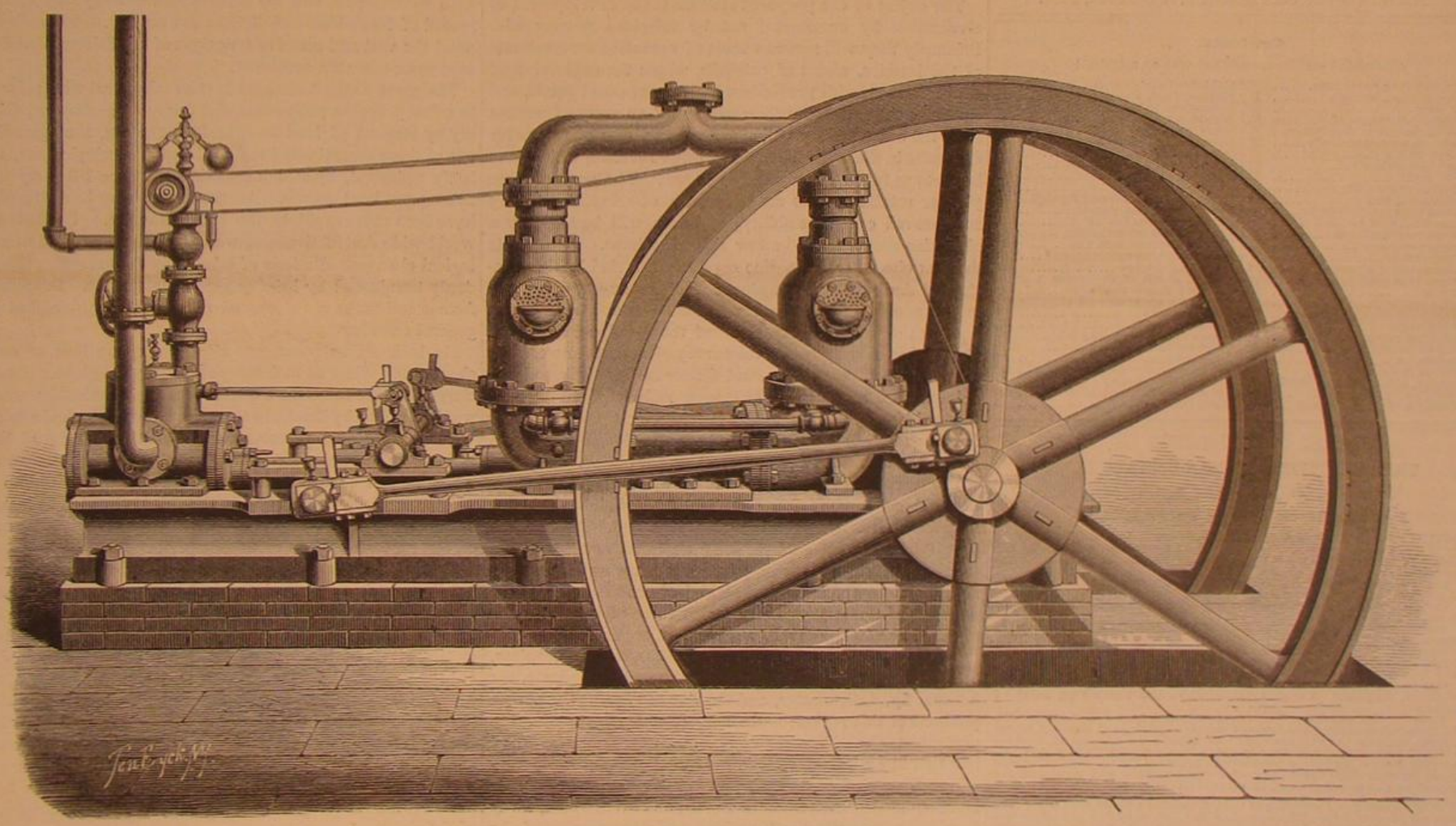
The new air compressor herewith illustrated may be operated by steam or water power, and is available for work in mines, tunnels, or quarries, for driving rock drills, coal cutters, and hauling and pumping engines, working mining pumps, for use in factories, and in fact for all service where a safe and efficient power is required. The construction of the machine, the capacity of which differs according to the amount of power required, will readily be understood from the illustration. Above the air cylinder are two distinct air chambers, each having two induction or receiving valves, which cushion on rubbers. With the movement of the piston these chambers alternately receive and force the compressed air through check valves placed in the upper part of the air compartment, both compartments being connected with one pipe conveying the air to the ordinary air receiver. These check valves lift alternately, and cushion on water; and as the compressed air is forced into the pipe connecting with the receiver, without a possibility of any of it escaping back into the receiving chambers, it is claimed that there is the smallest possible loss of power, and that the machine will give fully 90 per cent of steam power expended in the shape of compressed air. The compressor is compact in form, strongly made, simple in construction, and not liable to get out of order. One peculiarity in its construction is that no water jacket or hollow piston is used; yet under any of the extreme pressures to which the machine has been tested, no inconvenience, we are informed, from heat has been perceptible.

In connection with the compressor, receivers of various sizes are used, into which the air is pumped and thence conveyed by pipe to the location where required, even if it be a mile or more, the loss by friction between receiver and point of utilization of the air being, it is claimed, under 2 lbs. of the pressure.

The manufacturers also build water-power compressors, one of which, driven by 75 to 100 horse power, they have recently shipped to Utah. The machine is intended to convey the air through iron tubes 5,000 feet to the mouth of a silver mine, where a 50 horse power hoisting and a 25 horse power pumping engine will be driven by air instead of steam, and a tube will be extended into the mine 1,000 feet deep, where the power drills and small pumps will be operated by air also.

The manufacturers submit a number of excellent testimonials from parties using the machine. From one, we learn, that at the Antelope and Prince of Wales mine, near Alta City, Utah, the compressor runs 10 hours per day, and supplies compressed air to two 3 inch drills used in running levels. The distribution terminates at distances of from 1,000 to 2,000 feet from the compressor. The machine also drives one hoisting engine and ventilates the lower part of the mine. The main supply pipe is three inches in diameter, 2,300 feet long, and is tapped by two inch pipe wherever power is required. The expenditure of fuel is one cord of green pine wood and 600 lbs. of bituminous coal per 10 hours. Air pressure in receiver 100 lbs. This pressure is reported to be obtained by 70 lbs. of steam as indicated by the gauges.

For further particulars, address the manufacturers, Messrs. Griffith and Wedge, Zanesville, Ohio.



BOWER'S AIR COMPRESSOR.

Death of Professor Santini.

A cable dispatch announces the death of the Italian astronomer, Giovanni Santini. The Professor was born at Tuscany, June 30, 1786, and was in the ninety-first year of his age. He graduated at the University of Pisa. He soon devoted himself to a study of the exact sciences, and in 1814 he had achieved so much distinction that he was appointed to a professorship in the Padowa Observatory in place of Vincenzo Cheminello. In 1825 he was appointed Rector of the University, and up to the time of his death he held the position of Professor of Astronomy and Director of Mathematical Studies. He was generally esteemed by the learned societies of Europe, and held a number of honorary titles and degrees from various leading universities. He was also a correspondent of the French Academy. The principal books published by him are strictly scientific, such as "Decimal Arithmetic" (1808), "Elements of Astronomy" (1820), "Logarithms and Trigonometry," and "Optical Problems" (1821–23). Some of his elementary works on astronomy for beginners are the best ever published in Italy.

John Yule.

The death is announced of Mr. John Yule, of the Hutchestown Engine Works, Rutherglen, N.B., at the age of 66. During early life, Mr. Yule went the round of the best engineers' shops in Scotland and England, and became one of the recognized leaders in engineering progress. His inventiveness took various directions, amongst other fruits being an improved rotary engine, a compensating governor for the steam engine, and a screw tap, drill, and mandrel. For the latter he was awarded the silver medal of the Scottish Society of Arts. For some years Mr. Yule acted as the manager of the boiler department of Messrs. Robert Napier & Son's establishment, but eventually resumed business at the Hutchestown Works, and devoted attention amongst other matters to the improvement of swing bridges and steam cranes and hammers. In the former line two of his most important works are the plate girder bridge over the entrance to one of the docks at Port Glasgow, for the Caledonian Railway, erected from plans by Messrs. Bell and Miller, C.E., Glasgow; and a lattice girder bridge over the entrance to Kingston Dock, Glasgow Harbor. Owing to the angle at which this last bridge crosses the dock, great difficulties were experienced in working out the mechanical details so as to admit of easy motion. These were skillfully overcome, and the bridge was, as finally erected, a monument of his design as well as workmanship. The Blackhill incline on the Monkland Canal, constructed nearly a quarter of a century ago, is a sample of Mr. Yule's mechanical powers. Of late years he was largely engaged as a professional valuator.

Business Prospects.

We have recently taken the pains to make inquiries from the more eminent bankers and merchants in the chief cities of the interior, and the results of our inquiries have tended to confirm the belief we have more than once expressed in this journal, that although, from various causes, there is overhanging a portion of our American industries a cloud of gloom and depression, still throughout the nation at large there is going on a process of growth and recovery from which the best results are anticipated. How long we shall have to wait before the life which is at work silently and secretly beneath the surface will put forth its full power, in the full harvest of productive activity, is, of course, impossible to foretell. What is chiefly important for us to know, however, is that the progress we are making tends upwards and not downwards, and that it promises to lead our industry and commerce to a brighter and not to a darker future.—*Financial Chronicle.*

To Disinfect Rooms.

The disinfection of a room is not complete unless the walls have been thoroughly cleansed. If they are papered, the paper must be removed and the surface beneath carefully scraped and washed. If the walls are painted, they should be washed with caustic soda. The ceiling should also be subjected to a similar treatment.

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Scientific American.

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VOL. XXXVII., No. 2. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, JULY 14, 1877.

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Health and Sewage of Towns; by ALFRED CARPENTER, M.D., C.S.S. A practical experience of the Dry system.

Carlisle Bridge, Dublin, 1 engraving.—Extinction of Fires.—Important Dutch Enterprise.

Foot Bridge across the River Ness at Inverness; by C. R. MANNERS, Engineer. 13 illustrations.

Radiating Steam Hercules for the St. Heliers' Harbor Works, Jersey. 2 figures.—New Meat Trucks.—New Horseshoe.—Scott's Wheel-Cutting and Moulding Machine. 3 figures.

Compound Engine with Rope Driving Gear; by BENJAMIN GOODFELLOW, Engineer. 3 engravings.—Differential Screw Pipe Joint. 6 figures.

Pipes for Gas and Other Purposes (continued from SUPPLEMENT No. 77). Main-laying continued, with 4 figures.—Fittings of Gas and Water Pipes; Includes the average "life" of pipes; an account of various soils, and amount of corrosion in each; Professor Barff's new iron-preserving process, and other processes in practical use for preserving iron pipe; proving pipe; the utility of various metals and directions for pipe-laying: various fittings, illustrated in 16 figures.

II. TECHNOLOGY.—The Sizing of Cotton Goods; a paper read before the Society of Arts, by W. THOMPSON, F.R.S. A very full and clear description, embracing: An account of the process of weaving, explaining the object and utility of size. A table of sizing mixtures in which are enumerated all the substances used, (1) for giving adhesive properties to the size, (2) to give weight and body to the yarn, (3) for softening the size or yarn, and (4) for preserving the size from mildew and decomposition. Tests for these substances and directions for mixing, so as to obtain the results required. Proportions of sizing. Use of flour in size. Weighting materials, China clay and its substitutes. "Softenings" and oils for softening. East winds. Glycerin, grape sugar, mildew preventives, and tape sizing. "Slashing," packing, mildew, damaged goods, etc.—Notes on Garment Dyeing. Giving preparation of garments with cotton warps, green on garments with cotton warps, brown on the same, etc.

III. LIGHT, HEAT, ELECTRICITY, ETC.—On the Minute Measurements of Modern Science. By ALFRED M. MAYER. Article IX. The dividing engine and methods of making accurate linear scales. 8 illustrations.

IV. NATURAL HISTORY, ETC.—Catastrophism, or the Evolution of Environment. An address by Clarence King before the Sheffield Scientific School of Yale College, New Haven, Conn.

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VI. MISCELLANEOUS.—The New German Patent Law: being the Full Text of the New Law for Patents, passed July 1, 1877, covering all the States of the German Empire.

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CARRYING PEACE INTO AFRICA.

To carry war into Africa has been a proverb ever since Rome vowed the destruction of Carthage. But the Carthagenian invasion was a modern episode in Africa's experiences of that nature. On one of the earlier monuments of Egypt there is figured a slave-hunter's raid upon an Ethiopian village, the horrid details of which are said by travelers to be an accurate picture of a slave raid of to-day. The same murderous work has been going on incessantly for at least 4,000 years: how much longer there is no telling. For all these ages the African borders have known war and war only, and of the most destructive and barbarizing nature.

Recently, under the influence of Sir Samuel Baker, Colonel Gordon, and the civilized world in general, the Khedive of Egypt has carried war into the interior in the interests of peace: a conquest in a measure justified by the suppression of inter-tribal war for the filling of slave pens, and the abolition of the slave trade down the Nile. A similar reform has been effected on the east coast by the pressure of English power on the Sultan of Zanzibar. And the immediate effect of these two movements has been to prevent the butchery or enslavement of not less than half a million negroes annually.

A still more promising invasion of Africa has just been decided upon in the International Geographical Conference in Brussels: an invasion wholly in the interests of peace and civilization. At the meeting, a year ago, it was declared advisable to establish, by international effort, a line of permanent commercial stations from Bagomoyo, on the coast of Zanzibar, to St. Paul de Loanda, on the opposite Atlantic coast; the first stations to be at Ujiji, where Stanley found Livingstone, on the eastern shore of lake Tanganyika; at Nyangwe, Livingstone's furthest point northward on the Lualaba; and at some point further west on the route of Cameron, to be fixed in the dominions of Muata Yamvo, one of the most powerful chiefs of Central Africa. At the second conference, which ended June 24, arrangements were made for sending out the first expedition toward Tanganyika.

The object of the proposed stations is the development of civilization by commerce, not by religious propaganda. Primarily they will serve as bases of operation for explorers of the interior, a sort of *entrepôts*, where the explorer may supply himself with provisions, instruments, and goods, and thus save the cost and embarrassment of an army of porters from the coast. They will also serve as places of refuge for explorers in times of sickness and other reverses, which have hitherto so terribly hampered explorers. The heads of these pioneer establishments are to be men of scientific training and proved executive ability; and each will be aided by a physician-naturalist and a few skilled artisans. The points thus far chosen are on a line regularly traveled by the caravans of Arab traders, carrying coffee, tea, sugar, arms, and woven goods to permanent Arab residences and trading stations in the interior. An agent of the London Missionary Society has already begun the survey of a route for ox teams as far as lake Tanganyika; and Cameron has expressed the opinion that a light narrow-gauge railway could be constructed from the coast to the lake at a cost not exceeding four thousand dollars a mile. The traffic along such a road, he thinks, would soon pay interest on the outlay.

The unexplored region thus to be opened up to civilization and commerce (other than in human beings) is larger than the United States east of the Mississippi. Around it is a still larger region of partially explored country of unequalled fertility, abounding in great lakes and navigable rivers, and for the most part so high above the sea that the products of the tropics mingle with those of the temperate zone. The cereals, durah, maize, rice, sugar cane, starch-yielding roots and tubers, cotton, coffee, tobacco, spices, gums and caoutchouc, dye-stuffs and medicinal plants, the banana, fig, date, orange, and the vine are among the known products of this region; and all are capable of becoming important staples of foreign commerce. The country is not less rich in coal, iron, copper, gold, and other valuable minerals. The climate, though moist from abundant rain, is less debilitating than India or Brazil; and everywhere, away from the miasmatic coast regions and the marshes of the lower river courses, European explorers have found small cause for complaining of excessive heat or unhealthiness. On the elevated plateaus which cover so large a part of Central Africa, the climate is like that of the sanitariums of India; while among the mountains the finest climates of the world are fairly rivalled. Stanley found in the mountainous region between the great lakes and within a degree of the equator every climatic condition and every element of landscape beauty that could attract and delight a white colony. It was a perfect alpine country, with mountains rising from twelve to fifteen thousand feet, yet free from alpine cold and snow. Countless torrents from the hills watered ever-verdant valleys as beautiful as those of Tyrol, lying under a brilliant equatorial sun, yet with a climate as cool and equable as any European might desire. Further south, among the mountains about Lake Nyassa, the same features are presented on a grander scale: a country aptly described as a second Switzerland of gigantic proportions.

There can be no question of the ability of Europeans to sustain themselves in the greater part of the interior—certainly on all the higher plateaus—nor of the possibility of building up in Central Africa a great civilized empire. Nature offers every facility, and the native population seem to be well fitted for productive industry. In every respect they are physically and morally superior to the negroes of the coast, and only need protection and the encouragement of legitimate commerce to weld them into a great nation. Already they stand on the borders of civilization. They are intelligent, industrious, and not unskillful in the manufacture of iron and copper ornaments, utensils, and weapons. The arts of tanning, spinning, weaving, dyeing, mat-making, etc., are widely diffused among them, and many of their products are remarkable for their fineness and strength. They carry on agriculture with considerable success; and, notwithstanding the chronic state of insecurity incident to slave-hunting, their wealth in cattle is very great. As soon as the disturbing and impoverishing influence of the slave traffic is abated, and a market provided for the products of peace, the advancement of the people in civilization is likely to go on with great rapidity. As the source of raw materials which we need, and as a market for the surplus manufactures of Europe and America, the country offers, to say the least, many attractions; and it will not be surprising if, within fifty years, thriving commercial stations will be founded on all its great lakes and rivers, and connected with the outer world by telegraphy, railways, and steamship lines.

ADDRESS OF CLARENCE KING ON CATASTROPHISM.

Mr. Clarence King lately delivered an interesting address before the Sheffield Scientific School of Yale College, New Haven, Conn., under the title of "Catastrophism, or the Evolution of Environment," which promises to evoke considerable discussion. We subjoin an abstract of the principal features of the address, which is quite lengthy. The full text will be found in our SUPPLEMENTS, *Nos. 80, 81.*

Mr. King refuted the doctrine of slow evolution as taught by Huxley and Darwin, and declared that the surface of the earth and climate had been subject to sudden and catastrophic mutation, which included in its environment all types of life.

He reasoned that marine fossils are found entombed in rocky beds far remote from present seas; and that these beds were once sea bottoms that have been upheaved by convulsions of Nature. The earliest history of mankind is pregnant with catastrophe, and we have historic story and biblical record of its sudden and destructive energy. He called to mind the vast and massive eruptions of the Pliocene basalt as seen upon our own continent.

The great obvious changes in the rocky crust were referred to a few processes; the sub-aerial decay of continents, delivery by streams of land-detritus into the sea, the spreading out of these comminuted materials upon a pelagic floor, and lastly upheaval, by which oceanic beds were lifted up into subsequent land masses. All these processes he declared to have been more rapid in the past than now. Suddenness, world-wide destructiveness, were the characteristics of geological changes. Periods of calm, like the present, are suddenly terminated by brief catastrophic epochs. Successive faunas and floras were created only to be extinguished by general cataclysms.

He believed in recurrent, abrupt accelerations of crust change, so violent as to destroy all life on the globe. He declared the idea to be the survival of a prehistoric terror, and was backed up by breaks in the great palæontological record.

Of the geologic features of our continent, he said that beneath our America lies buried another distinct continent, which he called Archæan America, which was made up of what was originally ocean beds lifted into the air and locally crumpled into vast mountain chains, which were in turn eroded by torrents into mountain peaks. The original coast lines of this continent we may never be able fully to survey, but its great features, the lofty chains of the mountains which made its bones, were very nearly co-extensive with our existing systems, the Appalachians and Cordilleras. The cañon-cutting rivers of the present Western mountains have dug out the peaks and flanks of those underlying, primeval uplifts and developed an astonishing topography; peaks rising in a single sweep 30,000 feet from their bases, precipices lifting bold, solid fronts 10,000 feet into the air, and profound mountain valleys. The work of erosion, which has been carried on by torrents of the quaternary age, brings to light buried primeval chains loftier than any of the present heights of the globe.

At the close of the Palæzoic age, two enormous masses of what, probably, were then continents began to sink, and as they disappeared the present Atlantic and Pacific oceans appeared, while the sea-floor of a then ocean, emerged, and became the new continent of America. Dividing this new continent was a sea, but catastrophe removed this sea and resulted in the folding up of mountain ranges 20,000 and 40,000 feet in height, thereby essentially changing the whole climate of the continent. Of the land life of the mesozoic age we have abundant remains. The wonderful reptilian and avian fauna of the mesozoic age is now familiar to all. But after the catastrophe, and the change of climate which must necessarily have ensued, this fauna totally perished.

After criticising the opinions of Huxley, Lyell, Hutton, Darwin, and others, he recurred to the effects of sudden terrestrial or cosmical changes, and conceived that the effects of these changes would be, first, extermination; secondly, destruction of the biological equilibrium; and thirdly, rapid morphological change on the part of plastic species. When catastrophic change burst in upon the ages of uniformity, and sounded in the ear of every living thing the words "Change or die!" plasticity became the sole principle of salvation. And plasticity is the key to survival and prosperity. Mr. King remarked in conclusion of his address: "He who brought to bear that mysterious energy we call life upon

primeval matter bestowed at the same time a power of development by change, arranging that the interaction of energy and matter, which make up environment should, from time to time, burst in upon the current of life and sweep it onward and upward to ever higher and better manifestations. Moments of great catastrophe, thus translated into the language of life, become moments of creation, when out of plastic organisms something newer and nobler is called into being."

DUPLEX EDUCATION.

The age in which we live is a fast one, and he who does not move with equal celerity, and keep pace with those around him, is ruthlessly thrust to the wall, and remains there unless he has strength and will to regain the lost position. We call to our aid every force of Nature and invoke the assistance of every appliance with which we are cognizant. We call our fathers slow, and to us they were so; but there was the same need of celerity in their every-day life as to-day there is in ours.

While calling to our aid the elements of Nature and adapting thousands of mechanical appliances to our wants, do we not often feel that there is beyond all these a "something" that may be invoked and trained to help us on in the race of life? Occasionally we find dim glimmerings of this "something" that we believe will eventually grow to be one of the prominent sciences. Physiologists tell us that the human brain is double, that the right and left lobes act in a degree independent of each other—the right lobe of the brain controlling the physiology of the left side of the individual from head to heel, while the left lobe exercises a like dominion on the opposite side. Grant this to be true, then can be explained the idiosyncrasy that is occasionally seen in individuals, of which we may instance that of writing at the same time with both hands; and again we have heard of telegraph operators sending and receiving two messages at the same time, operating with both hands and independent of each other. It is said that Nasmyth, the inventor of the steam hammer, could actually produce two sketches or drawings in this way and at the same time. It is also affirmed that Sir Charles Fox, the architect of the Exhibition building of 1851, could write upon two ideas at the same time and transfer these ideas simultaneously to paper with right and left hand. The mechanic can often be found who can operate upon one piece of mechanism, while at the same time his brain is busy upon the study of some unborn idea, foreign to that work upon which he is laboring. Writers can be found who can write out one train of ideas, while ideas entirely different are being cogitated upon somewhere in their craniums. We have even heard it affirmed that an indistinct glimmering of a third idea would occasionally peep around the corner of the caputs of these favored ones.

Why not educate this? Why not form schools and institutions to bring it out and lead the brain to perform this double function? It can certainly be done. The world wants it, surely. The age demands it. Individuals need it. If these individuals can succeed and become experts in this method of double work, will not double compensation and a greater remuneration be their reward? This, certainly, will be an incentive to its acquirement. Go to the apprentice when first he takes position beside the vise, with chipping chisel in one hand and hammer in the other. The injunction he mentally receives as he raises the hammer is, that to miss the chisel is to hit his knuckles. After a few demonstrative blows he knows what it means, and therefore chisel and hammer soon come by some strange process to harmonize in action, so that in whatever position the head of the chisel may be, the blow is sure to be properly received, and that, too, without any sensible effort on his part. In this illustration both right and left hand are taught to act, by brain dictation, in a certain concerted manner.

Again, we find that mutes have been learned to articulate words and sentences by proper education, they being taught to imitate the motions of the mouth and labial organs as by their tutors directed. Education can do much, and these are some of its results. Can we not by proper teaching produce all the results as shown in the case of Nasmyth and Fox. The first lessons must necessarily be simple. For instance, two things done at the same time with both hands, giving expression at this time to ideas connected therewith, but distinct from each other. From this simple lesson we progress, and, as the ultimatum, we may arrive at greater achievements than Nasmyth or Fox ever dreamed of. We may find that we can so divide our entity that we can be conscious of a double-brain existence in a dual action.

THE CARRIGEEN CROP.

To the great majority of people, Carrigeen, under the more familiar name of Irish Moss, is known chiefly as the basis of a pleasant and wholesome drink for the sick room, or as an article of use in the preparation of delicacies for the table. Comparatively few are aware of its wide and varied use in the arts, or that the thousands of barrels of it employed annually by our manufacturers of paper, cloth, felt, and straw hats, etc., and by brewers, is not an Irish, but an American product, and, speaking strictly, is not a moss but a seaweed.

Carrigeen (*chondrus crispus*) is to be found more or less abundantly all along our northern coast, ranging between the low water line and the depth of forty feet, or so; but as a rule its fronds, which correspond to the leaves of air plants, are so numerously inhabited by small mollusca that they are spoiled for other use. The clean-growing article seems to be limited almost wholly to certain ledges in the neighborhood of Scituate, Mass.—a section of coast guarded by the celebrated Minot Ledge Lighthouse, and famous for its danger to shipping. Here, where the waves of the Atlantic dash with full force upon the rocky coast, the carrigeen grows to perfection; and wherever it escapes the spawn of mussels and other shellfish, is gathered during the summer season in vast quantities.

The harvest begins in May and ends about the first of September. The gathering is made in two ways—by hand-picking during exceptionally low tides, and by means of long-handled iron-toothed rakes at ordinary tides. Of course the work cannot be carried on except during fair weather. Hand-pulling is possible only during the bi-monthly periods of spring tides, that is, when the moon is full and again at new moon. At such times high tide occurs about midday and midnight, and the ledges are exposed for moss gathering morning and evening. The mossers' boats are rowed to the rocks where the finest grades abound, and the gatherers select with great care the growths that are freest from minute shells and other foreign matter. This portion of the crop, if properly handled afterwards, generally goes to the apothecary and fetches a price two or three times that of the common grade.

As the tide rises the pickers are driven to their boats, and proceed to the outer moss-bearing rocks where the rake is used, as it also is during ordinary low tides. Moss taken in this way is not so clean as the hand-picked, and is always mixed with tape grass, which must be removed during the process of curing and packing.

The curing of the moss is the most critical part of this peculiar farming. On being brought to the shore the moss is black and unsightly; it must be bleached as well as dried. The bleaching is effected by repeated wetting and drying in the sun; and as the moss is readily soluble in fresh water the bleaching beds are situated near the banks of the salt creeks that abound along the shore. After drying, the moss is packed in tubs and rolled to the water, where it is thoroughly washed, then rolled back to the bleaching bed, to be dried again in the sun. Five or six such exposures are usually sufficient. On the bleaching ground, the moss is carefully spread and turned, and watchfully guarded against wetting by rain. In this process it turns from black to red, then to the yellowish-white of the perfected article. When properly cured the moss is stored in bulk, in shanties; where, as time permits, it is picked over and packed in barrels. The crop averages about half a million pounds a year; and thanks to the brighter and more abundant sunshine of our coast, the moss has a brighter color and is of finer quality than the Irish product.

CATASTROPHISM IN GEOLOGY.

Mr. Clarence King was probably not a little surprised to learn from the *Tribune* that in his most suggestive address on "Catastrophism and the Evolution of Environment," he had turned the guns of Geology upon Biology; and that in calling attention to the influence of periods of accelerated change in environment upon exposed types of life he had swept away the "fundamental doctrines upon which has been built the scheme of development by natural selection and the survival of the fittest." Certainly nothing in the address betrays any consciousness of possible effects of that sort. And it is quite probable also that Mr. King will have to suffer some annoyance from seeing his name set up at gaze, like Joshua's moon in Ajalon, by the unscientific press generally, as that of the newest champion of orthodoxy against the leaders of modern scientific thought: a penalty which scientific men always have to pay for emphasizing neglected truths.

Mr. King certainly deals some telling blows against the position of the stricter school of Uniformitarians in geology, and brings into prominence a much neglected element in the struggle for existence; but there is no scientific revolution threatened, nor are any crumbs of comfort spread for those endeavoring to arrest the natural drift of scientific progress.

The issue between Mr. King and the sticklers for uniformity in rates of geological change is simply this: In the reaction against the sweeping cataclysms, the sudden wipings out of whole creations and the sudden introductions of new worlds of life believed in by earlier geologists, the modern English school has come to look upon time and the slower modifications of the earth's surface, now observable, with the struggle for existence under easy conditions, as the chief factors in geological change and its accompanying variations in the forms of life. Mr. King, on the other hand, insists that in so doing they have taken too little account of catastrophic changes, that is, widespread and sudden movements of sea and land. In other words, he raises rapid change of environment from the subordinate place it has hitherto occupied in the scheme of historical development, and gives special emphasis to the grand geologic movements which have to do with such changes.

In this Mr. King has unquestionably rendered good service to the science he has done so much to extend and honor in the field; while the illustrations from American geology which he brings to bear on the subject are as likely as his sturdy opinions to attract attention. Yet we are inclined to think that in some things he has allowed his enthusiasm to run away with him. The stolid self-confidence of extreme Uniformitarians has tempted him to exaggerate the periodic accelerations of geologic and biologic movement, and to overstate their effects quite as much as others have underestimated them; and when he charges the followers of Lyell with intellectual near-sightedness and a lack of "the very mechanism of imagination," they may possibly be able to retort not unjustifiably that he has mistaken the natural foreshortening of the geological vista due to distance for actual brevity; and that his belief in the abruptness and suddenness of the great changes which the earth's strata record, may be due to his own lack of sustained imaginative power for grasping and interpreting all the evidences of the enormous time really involved. But this is a question not of imaginative capacity but of logical deduction from observed facts; and however abrupt the beginning of some of the great geologic movements may have been, their subsequent progress cannot in all cases have been so rapid as to allow of their being called catastrophic in any ordinary acceptation of the term.

Take, for example, the alleged catastrophe which marked the close of the mesozoic age in the West. Of this movement Mr. King remarks: "In a quasi-uniformitarian way, 20,000 or 30,000 feet of sediment had accumulated in the Pacific and 14,000 in the [American] mediterranean sea; when these regions, which, during the reception of sediment, had been areas of subsidence, suddenly upheaved, the doming up of the middle of the continent quite obliterating the mediterranean sea and uniting the two land masses into one. The catastrophe which removed this sea resulted in the folding up of mountain ranges 20,000 and 40,000 feet in height, thereby essentially changing the whole climate of the continent."

That this great change occurred, and was attended with an obliteration of the wonderful reptilian and avian fauna of the mesozoic age, is most true: that it occurred suddenly does not appear. On the contrary, there is evidence to show that the prodigious folding up of mountain ranges involved could not have proceeded with sufficient rapidity to turn the course of a stream of water. It happened that one of those folds—one which, had no denudation been going on meanwhile, would have lifted its crest higher than the highest peak of the Himalayas—lay directly across the course of the Colorado river. The river held its course uninterruptedly, sawing its way through the uplift until six vertical miles of rocky strata had risen past it. At no time, therefore, could the rapidity of motion in the bulging strata have exceeded the capacity of the river to wear away the obstruction, and the bulge was fifty miles across! We do not know how rapidly a river may sink its channel through such a rising barrier; but we do know that a process of that nature cannot legitimately be described as swift or sudden. And surely it requires not less intellectual far-sightedness and imaginative faculty to carry the mind across the enormous stretch of time involved in such a change slowly wrought—a period during which at least three vertical miles of the rising mountain fold was worn down by rain and atmospheric abrasion—as to mass the continental doming, the mountain folding, and the attendant life changes together as a convulsive "catastrophe."

Mr. King, however, is not a Catastrophist of a very violent sort. He shelves among the errors of the past the belief in such cataclysms as Cuvier believed in, involving world-wide destruction of all life—"the mere survival of a prehistoric terror, backed up by breaks in the paleontological record and protected within those safe cities of refuge, the Cosmogonies;" though he rejects as equally unsatisfactory the mild affirmations of the Uniformitarians, that existing rates of change and indefinite time are enough to account for all the geological record. With our present light, he holds, geological history seems to be a dovetailing together of the two ideas. "The ages have had their periods of geological serenity, when change progressed in the still, unnoticeable way, and life through vast lapses of time followed the stately flow of years; drifting on by insensible gradations through higher and higher forms, and then all at once a part of the earth suffered short, sharp, destructive revolution unheralded as an earthquake or volcanic eruptions." Thus stated, his position does not seem to be radically different from that of the broader Uniformitarians, except that he marks the periods of accelerated physical change, and not those of comparative quiescence, as the dominant ones in their influence on life-change. He takes high and strong ground, too, in insisting that it is the business of geology not simply to decipher and map out the changes which have taken place in the configuration of the globe and in its climatic conditions, but also to investigate and fix the rates of change. And when the evolution of environment takes form as a distinct branch of geology, he expects to witness a marked modification in the dominant views of biologists. Its few broad laws will include "neither the absolute uniformitarianism of Lyell and Hutton, Darwin and Haeckel, nor the universal catastrophism of Cuvier and the majority of teleogists." "Huxley alone among prominent evolutionists opens the door for a union of the residue of truth in the two schools, fusing them in his proposed evolutional geology."

So, on looking back over a trail of thirty thousand miles of geological travel, Mr. King is impelled to say that Mr. Huxley's far-sighted view perfectly satisfies his interpretation of the broad facts of the American continent.

Of Mr. King's observations in regard to plasticity of physical structure in connection with rapidly changing environment and the struggle for existence, we propose to speak at another time.

THE great stone monuments of England, like Stonehenge, are supposed, by Mr. James Fergusson, to be military trophies, erected in the time of King Arthur on the battle fields by the victorious armies.

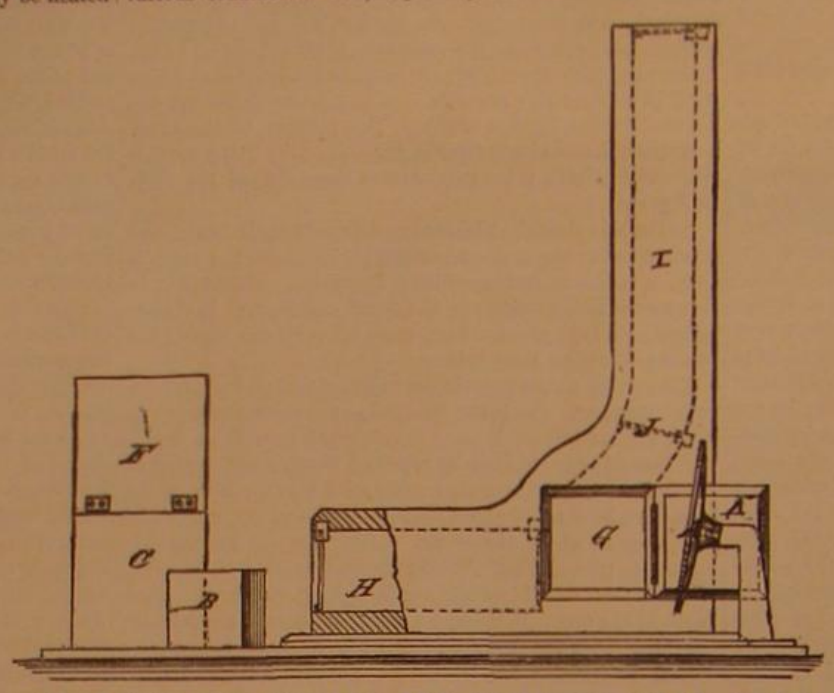
A NEW APPARATUS FOR STORING AND UTILIZING SOLAR HEAT.

The apparatus herewith illustrated is devised to collect solar heat or other heat, store it up in a heat reservoir—a mass of iron or other suitable material—confine it in the reservoir until needed, keep it in such form that it can be transported from place to place, and utilize it for industrial or other purposes.

A is a concave mirror for concentrating the solar rays upon the heat reservoir, B, which is a mass of iron. C is the heat box for confining the heat until needed, and also for serving as package for transporting the heat reservoir when hot. G is the heat reservoir chamber, in which the heat is communicated from the hot reservoir to the air. Under certain circumstances the heat reservoir may be heated in the heat reservoir chamber. H is a devaporizing chamber, for extracting the moisture from the air by means of a deliquescent substance or other material or treatment. A vertical stack or flue, I, communicates with the heat reservoir chamber, for conveying the heated air away for use.

The device for concentrating the solar rays may be either stationary or movable, and, if movable, may be moved by hand, or automatically, to follow the sun. The various chambers mentioned will have valves, J, at the ends to regulate the passage of the air, and there will be a door, K, at the side or bottom.

Patented through the Scientific American Patent Agency, March 20, 1877, by Messrs. John S. Hittell and Geo. W. Deitzler, of San Francisco, Cal.



APPARATUS FOR STORING, AND UTILIZING SOLAR HEAT.

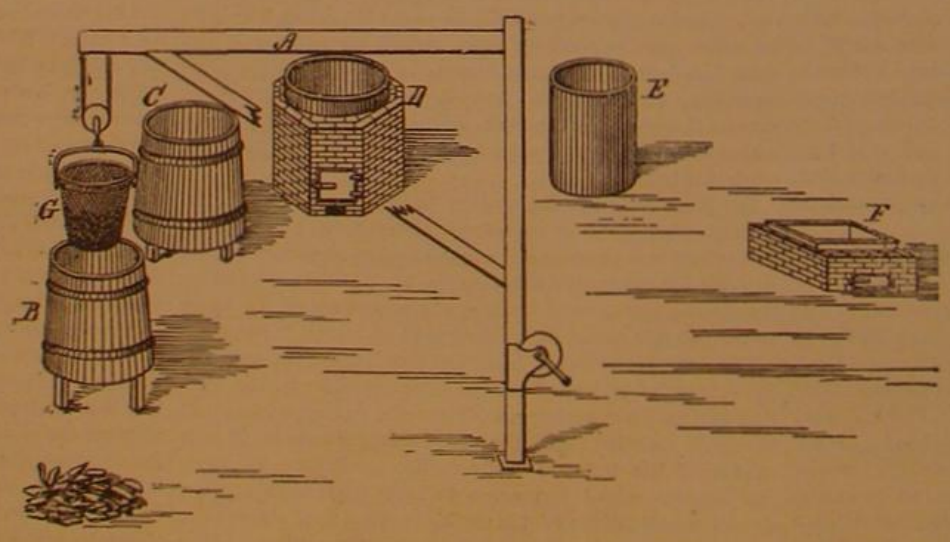
Phosphorescent Sweating.

While the subject of phosphorescence in marine animals was under discussion at a society meeting in Florence, Professor Panceri cited the case of a medical man, who, after eating fish, felt indisposed, had nausea, and sweats that were luminous. This idiosyncrasy was laid to the *pesce baudiera*, a Neapolitan fish. Dr. Borgiotti, another member of the Academy, also narrated a case of phosphorescent sweating in a patient with miliaria, a fact which has previously been noticed.

UTILIZATION OF TIN SCRAP.

Messrs. Charles A. Catlin and George F. Wilson, of Providence, R. I., have patented, May 8, 1877, a new process of utilizing tin scrap, whereby they claim the tin is recovered, either as a valuable salt of that metal or in the metallic form, and the iron or other metal is left as a scrap at once available for reworking.

In any suitable building, a crane, A, is erected and placed in the sweep of that crane; in any convenient order are a boiler, D, two tanks, B and C, an evaporating pan, F, and an additional tank, E. From the crane is suspended a wire basket to contain the scrap to be treated, so perforated as to admit of the ready entrance of the liquid when submerged in, and its ready escape when withdrawn from, the boiler, D, in which boiler is put a sufficient quantity of the solution of caustic soda or potash to allow of a complete submersion therein of the basket and its contents. The basket, G, is then filled with the material to be treated, sprinkling in during the filling the requisite quantity of common salt or other chloride and nitrate of soda or other nitrate, using these dry, not in solution, either previously mixed or shaken in together in the proportion of from three to five pounds each to every hundred pounds of scrap, the requisite quantity depending upon the thickness of the thin plate to be removed. The loaded basket, being elevated by the crane, A, is then swung round, and, by lowering, submerged in the hot or boiling solution of caustic soda or potash in the iron boiler, D, which may hold in solution a further proportion of the chloride and nitrate used, the heat of which solution is maintained by a fire beneath the boiler, or in any other and ordinary way. In the ensuing reaction the oxygen of the nitrate combines with the tin to form stannic acid, and this, in turn, combining with the alkali present, forms a stannate of that base, which, entering into solution, leaves the before-plated metal tin-free, the chloride present assisting in the reaction. A further and more complex reaction takes place, by which copious fumes of ammonia are evolved, which may be utilized by proper appliances. When the reaction is complete, the basket containing the now tin-freed scrap is withdrawn from the boiler, and suspended above it long enough to drain. It is then swung over the tank, C, containing water, in which it is washed by submerging and withdrawing several times, and in like manner the washing completed in the water of the tank, B. The contents of the basket being now discharged, it is again filled with fresh scrap in the manner already described, and the process repeated. The loss by evaporation from the boiler, D, is supplied by the wash water in the tank, C; this, in turn, being supplied by the wash water in the tank, B, to which fresh water is supplied as required. When the caustic solution is sufficiently charged with the tin salt, it is allowed to deposit the impure crystals, which, being removed and drained, are redissolved in water in the iron tank, E. This solution in the iron tank, E, after filtration or decantation, is again concentrated in the evaporating pan, F, the crystals of stannate being removed from time to time, drained and dried; or the impure crystals obtained in the boiler, D, may be mixed with fine charcoal or other reducing agent, and subjected to the requisite heat for the reduction of the tin to the metallic form.



CALLIN AND WILSON'S PROCESS OF UTILIZING TIN SCRAP.

New Alloy.

A very beautiful new alloy, intended to replace brass in various ornamental uses, especially in window and door furniture, has been invented by W. A. Hopkins, of Paris. The alloy is composed of copper, tin, spelter, or zinc and lead, which metals are manipulated. A crucible is placed in the furnace and fired to red heat, and into the crucible thus heated the metals are placed in the proportions of—tin 1¼ (say) 1 oz., spelter or zinc ½ oz., lead $\frac{5}{16}$ of an ounce. These are the proportions he prefers to use, as he has found them to give excellent and satisfactory results, but he does not intend to confine himself rigidly to the precise proportions named, as they may, perhaps, be slightly varied in some particulars without materially detracting from the beautiful color of the alloy which it is intended to produce. The molten metals are kept well stirred, and any impurities therein should be removed. When thoroughly mixed, this alloy, which is termed the first alloy, is poured off into ingot moulds and left to cool. Copper, in the proportion of eight parts to one of this first alloy, is then placed in the crucible and brought to melting heat, when the tin or first alloy is added and intimately mixed with the copper, for which purpose the molten mass must be well stirred for several minutes; it is then poured into ingot moulds for sale in the form of ingots, or it may be poured into pattern moulds so as to produce the articles required. This is the mode of manipulation which it is preferred to employ, as an opportunity is thus afforded of removing any impurities from the first alloy before mixing it with the copper; but all the metals may, if preferred, be mixed together in the proportions given and melted at one operation. By this means an alloy is obtained of great strength, and of a very beautiful appearance, and which is particularly suitable for small work, such, for instance, as window and door furniture and other house furniture which is usually made in brass or other alloy of copper, though it is not intended to confine its use to such articles.

Sebastin—An Improved Explosive.

In the manufacture of the explosive known as dynamite, an infusorial earth is used, which is filled with or made to absorb nitroglycerin. As compared with certain kinds of charcoal, however, the absorptive and retentive power of infusorial earth in small changes of temperature unfavorably affect the common dynamite, and cause a separation of the nitroglycerin from the infusorial earth. The improvement we now refer to is the invention of G. Fahnehjelm, of Stockholm, Sweden, and consists in the substitution of a highly porous and absorptive species of wood charcoal, in place of the earth heretofore employed. The author designates his production as "sebastin," and gives a number of interesting particulars as follow:

In order to produce a charcoal having the required quantities, the carbonization or coking must be done in such a manner as to completely destroy the organic substances, and to produce as porous a charcoal as possible. For this he selects by preference young trees or striplings or branches of poplar, hazelwood, or alder tree, and he burns them in an open fire. When the wood has been consumed he does not put out the fire by means of water, but leaves it to go out of itself. In this way he obtains a very inflammable and very porous charcoal, which can absorb more than five, and approaching six times its weight of nitroglycerin without any risk of the separation of the oil. The charcoal is pulverized in a wooden mortar, but it should not be reduced to too fine a powder, else it will not so completely absorb the nitroglycerin. The charcoal produced in the ordinary way, or by closed fire, is quite different as regards absorbing power. Charcoal of fir trees may, however, be used, and may acquire nearly the same qualities, that is, if charred a second time in a special oven.

By mixing the different kinds of charcoal, a material may be obtained possessing the required absorbing qualities, and an explosive compound may then be obtained of the rerequired power without loss of the necessary consistency—that is, without being too dry, which is not desirable. The charcoal not only serves as the best absorbent for the nitroglycerin, but it plays also an important part in the combustion. The nitroglycerin in exploding decomposes into steam, carbonic acid, nitrogen, and oxygen. In the explosion of dynamite with inert base the oxygen goes away without being utilized, but in the explosion of this new compound (the new sebastin as he calls it) a part of the absorbent charcoal is burnt by means of the liberated oxygen. The quantity of gas is thus augmented, and also the development of heat, whereby again the tension of this gas is augmented. As, however, the quantity of charcoal necessary for the complete absorption of the nitroglycerin is in all cases much larger than that which can reduce the excess of oxygen produced at the explosion into carbonic acid, he adds to the compound a salt, which also by the combustion gives an excess amount of oxygen which may contribute to burn the rest of the charcoal. For this purpose he uses by preference nitrate of potassa, which may be added without any risk, and which gives the explosive compound a very much greater rapidity or vehemence, and consequent force of explosion.

The composition of the new sebastin depends upon the objects for which it is to to be used, and the effects intended to be produced. The strongest compound, and even in this there is stated to be no risk of the separation of the nitroglycerin, is composed of 78 parts by weight of nitroglycerin, 14 of the wood charcoal, and 8 of nitrate of potassa; and when less power is required the proportions are varied, the second quality consisting of 68 per cent by weight of nitroglycerin, 20 of the charcoal, and 12 of nitrate of potassa.

To show the relative strength of the compounds, the inventor says: Let the dynamic force of pure nitroglycerin be represented by the number 2,884,043·6, then the dynamic force of the sebastin No. 1, as above, will be indicated by 2,416,575, and of the sebastin No. 2 by 1,933,079·4, while that of dynamite No. 1 (consisting of 75 per cent of nitroglycerin and 25 per cent of infusorial earth) will be represented by 674,694.

For the above qualities of sebastin the increased effect produced by the greater rapidity of the explosion must be taken into account also. The increase has not yet been measured, but is estimated at 10 per cent. The sebastin may also be compounded in other proportions of the constituent parts, but the object being to produce explosive compounds of the greatest force which it is possible to employ without danger, he merely mentions that the proportion by weight may vary from 50 to 80 per cent of nitroglycerin, 15 to 35 per cent of the prepared charcoal, and 5 to 20 per cent of the nitrate of potassa; the parts being taken by weight, as above stated.

A NEW METHOD OF BOOKBINDING.

The annexed engravings represent a new system of binding books, for which a number of important advantages are claimed. It obviates stitching, allows of each leaf being firmly secured, and hence is especially well suited for single-leaved books. It admits of plates and maps being bound in their proper places instead of being pasted in, and renders he book much stronger and more durable. The inventor claims a saving of 40 to 75 per cent of the time required for stitching, and of 50 per cent of the time needed in ordinary rebinding work.

The mode of operation is as follows: On receiving the sheets, the binder folds them and places them in consecutive order, according to the printer's signature. The front and bottom edges of the book are then trimmed so as to obtain two straight sides; and the backs of the sheets are cut off, transforming them into single leaves. Horizontal lines are now marked with pencil across the back of the book for the saw cuts; and a diagonal line, A, B, Fig. 2, is drawn to serve as a guide in replacing the leaves in their proper places. A thin coat of glue is next applied to the back; and when this is dry, the book is divided into sections of from four to eight leaves (without counting them) entirely disregarding the printer's signatures, but placing the sheets in their original order. The binder places the first section removed at his right hand, the next at his left, and so on,

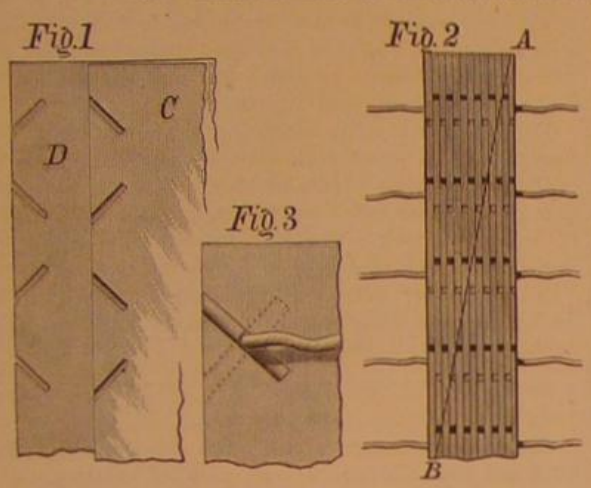
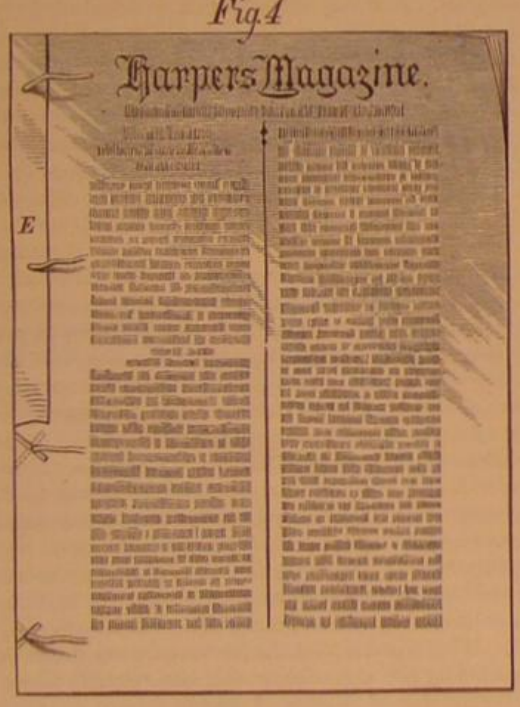


Fig. 4



forming two piles. Each pile is then straightened, and in the back of each, a little below the transverse lines, are made bevel cuts with the saw. Said cuts are ¼ inch in length, inclined at an angle of 45°, and so placed that one half their length is above and the other half below the marked line. When one pile of sheets is thus sawn, the other pile is similarly treated; but the corresponding cuts are made at relatively opposite angles. This will be understood from Fig. 1, in which C represents the edge of the right hand pile, for example, and D that of the left hand pile.

The sections of each pile are now returned in their regular order, according to the printer's signatures. Should a section have been misplaced, the diagonal line, being thus broken, will show the fact. It will be seen, however, that this arrangement involves the alternate use of sheets from each pile, so that, when all are put together, the beveled cuts will cross or form dovetails, as shown in Fig. 3. Half inch strips of white paper muslin, E, Fig. 4, are next pasted around the back edges of the first and last sections. This is done to strengthen the hold of the twines in the back of the book, said sections necessarily bearing the whole strain of the covers. The twine used corresponds in size to the holes made by the coincidence of the beveled saw cuts. This twine is passed through the holes by means of a blunt darning needle. The back of the book is shown in Fig. 2; and in Fig. 4 the twines are represented as passed. Nothing further remains to be done but to paste in the fly-leaves and lining, and finish the book in the usual manner.

It is evident that this a very much stronger method of securing the leaves than that in which the twine is simply laid and glued in a straight cut. Each leaf is independently fastened; and the thread is prevented from cutting through, as is commonly the case when the book has been used to any great extent. Books can be bound to open more or less as desired; and in rebinding, instead of taking the book apart and cutting threads, a thin shaving is sliced off the back, and the leaves are treated in the manner already described.

Patented March 20, 1877, by Mr. Florenz E. Schmitz. For further information, address Messrs. Schmitz and Slosson, box 1180, Middletown, Orange county, N. Y.

IMPROVED CURTAIN FIXTURE.

We illustrate herewith an improved curtain fixture, which may be adjusted to windows or curtains of different widths, and is adapted for use in connection with different means for raising and lowering the curtain. Fig. 1 represents the device in place, a portion of the cornice being broken away to exhibit it; and Fig. 2 shows the same in detail.

Fig. 1

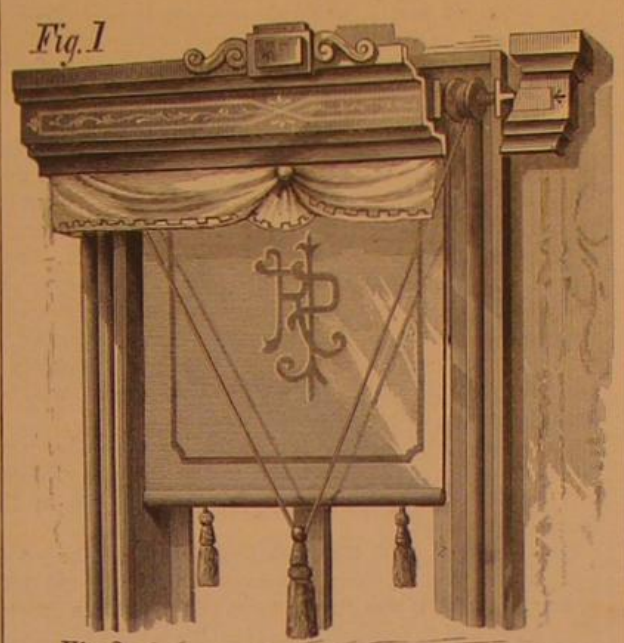
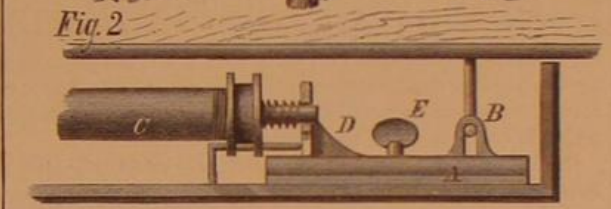


Fig. 2



Attached to the cornice are guides, A, in which are sliding loops, B. The latter may be adjusted to suit the position of the hooks placed in the window case to sustain the cornice, so that said hooks need not be set with any particularity. The curtain roller, C, has both its ends screw-threaded, to receive hollow pulleys, as shown. The spindles projecting from these pulleys are inclosed in coiled springs which press against the bearings, D, and so hold the shade in any position in which it may be placed. The bearings, D, are clasped in the ways, A, and are laterally adjustable. Sliding blocks are also arranged in said ways, and through each block passes a set screw, E. It will be perceived that the bearings may be readily adjusted to curtains of different widths, and the parts may afterward be locked in position by the set screws, E. The curtain may be raised or lowered by cords wound on the hollow pulleys.

Patented December 5, 1876, by Mr. R. J. Pospisil. For further particulars relative to sale of patent, address the Penn Patent Agency, 133 South Second street, Philadelphia, Pa.

BOOT AND SHOE MACHINERY.

No manufacturers have taken greater advantage of the ingenuity of the mechanical engineer than the American

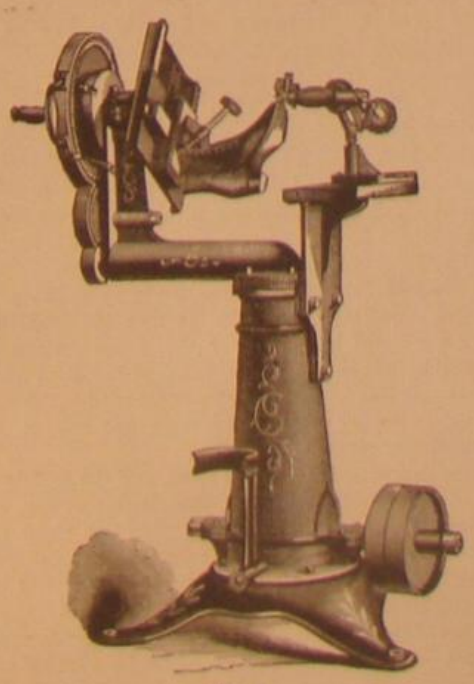


Fig. 1.

boot and shoe makers. Nearly every operation in the complex process of evolving finished boots from the plain skins of leather is the object of a special class of machinery; and for several years past, we have weekly chronicled the patenting of several improvements in the devices for effecting some of the numerous operations. We present herewith a series of eight labor-saving machines of the most approved construction, which we select from Knight's "American Mechanical Dictionary."*

Fig. 1 is a shoe-edge trimmer, in which the shoe is mounted on a jack, the carriage of which has a motion of translation and rotation communicated to it: so that, while the side of the sole is being trimmed, the shoe is fed longitudinally against the knife, but at the toe and heel is rotated beneath it. The knife is universally jointed, to permit the hands of the operator to determine the different bevels cut.

Fig. 2 is an ingenious little machine for placing the eyelets of the lace holes in position, and fastening them. The eyelets are fed, one by one, from the reservoir at the top, down the inclined ways, and are seized at the foot between the plunger and anvil, and they are riveted in their proper places in the shoe or strip of leather, which is held and fed by the operator.



Fig. 2.

Fig. 3 is a machine in which a shoe or boot is chucked and revolved against a burnishing tool, to impart a smooth and elegant finish to the heel. Our engraving shows a machine with what is called in the trade a "hot kit," a heated burnishing tool, with a flexible gas pipe of sufficient length, which follows the oscillations of the burnishing stock, *a*, and which conveys gas to the interior of the tool, where it is burnt in a jet. The tool is made to reciprocate over the surface of the heel, passing from breast to breast at each oscillation with an elastic pressure.

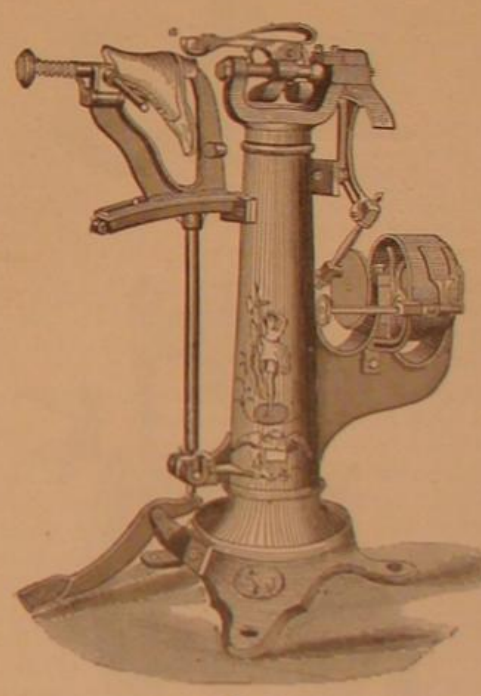


Fig. 3.

Fig. 4 is a machine for pressing together the "lifts" which compose a boot or shoe heel, thus dispensing with the handiwork of the hammer and lapstone. The bed is adjusted vertically by a screw to any thickness to which the blank heel may be built; and the plunger is brought down by the depression of the treadle with such force as to compact the lifts together.



Fig. 4.

Fig. 5 shows a heel-pricking machine. When the lifts of the heel are fairly pressed together by the appliance shown in Fig. 4, the pricking machine pierces the necessary holes through all the lifts at once by a gang of awls. The compressed heels are first secured together by tacking, and then placed on the platen; and the plunger, with its gang of awls, descends with great force.

Fig. 6 is a heel trimmer, known in the trade as the Coté trimmer. The shoe is held stationary by the treadle clamp; and the knife stock, which is centrally pivoted to the outer plate or jaw bearing upon the tread lift, is then grasped in the hands of the operator, and moved to give a sweeping cut to trim the heel.

Fig. 7 is a machine for pressing boot soles. Beneath the

* Published in numbers by Messrs. Hurd & Houghton, New York city.

crosshead of the press is a swinging bed, on each end of which is a form, in order that a shoe may remain under

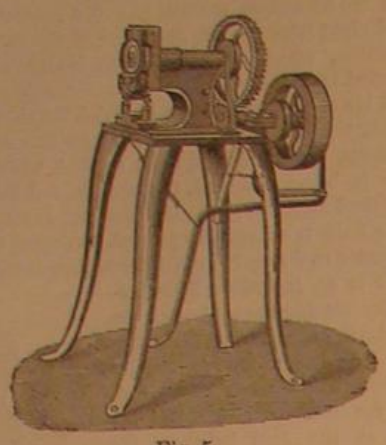


Fig. 5.

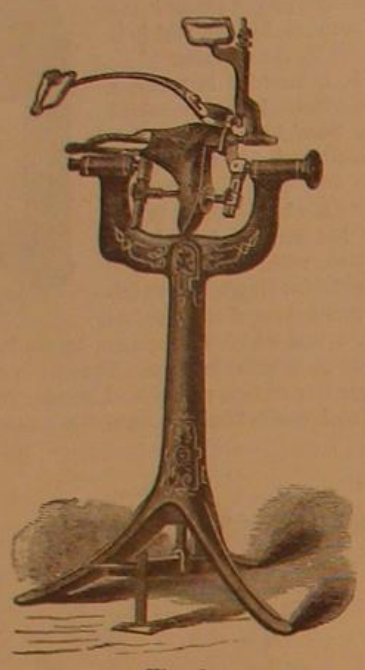


Fig. 6.

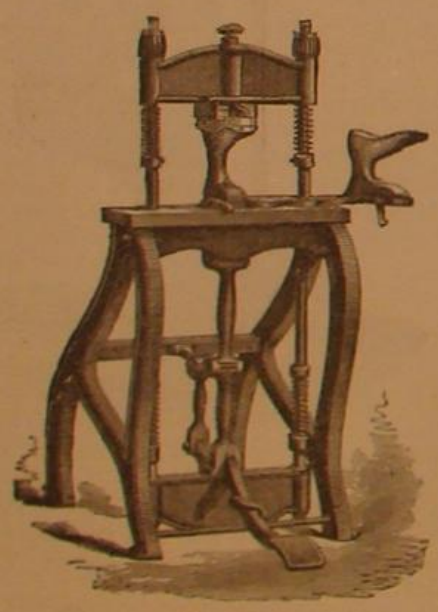


Fig. 7.

pressure upon one while the operator is placing another shoe on the other. The pressure is given by the treadle, which brings down the upper platen on the channeled sole.

On Dyspepsia.

At a late meeting of the Harveian Society, of London, Dr. Farquharson read a paper on this subject.

Attention was directed to the state of the tongue in dyspepsia. A deeply fissured tongue often meant little; whereas a thin white fur, composed of minute dots, was generally found along with pain immediately after food. Pain after a longer interval was accompanied by a pale, flabby tongue, with reddish tip and center. The treatment of dyspepsia consisted of two parts, that of food and that of drugs. The latter was the principal part with patients applying for gratuitous relief. The pain occurring immediately after food was usually relieved by alkalies; whereas acids were indicated where suffering was not experienced until an hour or two after the commencement of the digestive act. For the relief of the nausea and sickness remaining after the bowels were thoroughly cleansed, nothing was so effectual as hourly drop doses of ipecacuanha wine. Nux vomica was also a valuable remedy. Pain might be but the protest of the stomach against an overload, or be the result of deficient tone from general nervous exhaustion. In some cases each meal was followed by diarrhœa; and for these cases attention was directed to Ringer's plan of minute doses of the liquor hydrargyri perchloridi. In speaking of diet, Dr. Farquharson pointed out that there are three forms of dyspepsia: 1. The dyspepsia of fluids, as it is called, where the stomach seems intolerant of all forms of fluid; 2. The digestive derangement following intemperance in the matter of animal food; and, 3. The dyspepsia connected with indulgence in tea, or other warm and weak infusions of tannin.

The Destructive Effects of Lightning.

The amount of destruction of life and property by lightning, or rather electrical discharges, has been very great throughout the world.

It is estimated that at least 45 persons are killed annually by lightning in this country. The average number of deaths by lightning has been 22 in England, 9 in Switzerland, 3 in Belgium, and 75 in France. In France alone, during a period of thirty years, over 10,000 persons were smitten, of which 2,252 were instantly killed. Eighty were wounded and 9 killed during one thunderstorm at Châteauneuf les Montiers in 1861, and within one week, when the air was highly charged with electricity, thirty-three fearful flashes of lightning were observed, each bringing death to some victims.

During the sixteen years between 1799 and 1816, 156 vessels of the British navy were struck by lightning; 73 men were killed and 138 injured, and the loss of materials amounted to over a million dollars; but since the system of metallic conductors, adapted for vessels, devised by Sir W. Snow Harris, has been applied to the vessels in that navy, the losses and damages by lightning have almost entirely ceased, although the number of vessels has been greatly increased.

In Fuller's Church History it is stated that "scarcely a great abbey in England exists which once, at least, was not burned down by lightning from heaven."

On the night of April, 1718, twenty-four steeples were struck along the coast of Brittany; and on the 11th of January, 1815, twelve steeples suffered a similar fate in the Rhenish provinces.

On the 27th of July, 1759, lightning burnt all the woodwork of the great cathedral at Strasbourg; and on the 14th of August, 1833, it was struck three times within a quarter of an hour, and so much damaged that the repairs cost about $6,000,000. In 1835 lightning conductors were placed upon the building and steeple, and since then it has not been damaged whatever by lightning, although discharges have on several occasions occurred in line with the top of the steeple, which is 437 feet above the ground.

On the 18th of August, 1769, the Tower of St. Nazaire, at Brescia, was struck, and the subterranean powder magazine, containing 2,076,000 lbs. of powder, belonging to the Republic of Venice, was exploded. One sixth of the whole town was laid in ruins and the rest very much injured, and about 3,000 persons killed.

On the 26th of June, 1807, the powder magazine of Luxembourg, containing 28,000 lbs., was struck, and besides about 30 persons killed and 200 injured, the town was ruined.

Explosions and large fires, involving a great loss, have become rather frequent in this country, owing to the iron tanks used for the storage of petroleum being struck by lightning. From March to August, in 1876, over 10,000,000 gallons, and on April 19, 1877, over 2,000,000 gallons of oil, and the village of Troutman, were destroyed in the oil regions of Pennsylvania.

Some of the thunderstorms which have prevailed in this country have been very terrific and destructive. During August 14th, 15th, and 16th, 1872, portions of New York State and the New England States were visited by some of the most terrific thunderstorms ever experienced, during which over 200 dwellings were struck and damaged, about 10 persons were instantly killed, and 160 stunned. Quite a number of barns, with their contents, hay and cattle, were also struck, fired, and consumed. Cars, while running on some of the railroads, were surrounded by a vivid electric light, but no passengers were injured, although they were greatly alarmed. Telegraph wires were melted by the half mile, telegraph instruments broken, and poles shattered in all directions. One of these storms occurred at midnight, at Arlington, Mass., August 14th, in which brilliant streams of electricity darted across the sky in every direction, and the thunder which followed was constant for a period of thirteen minutes, without the intermission of an instant of silence. Three hundred and thirty-one discharges were counted in seven minutes by an observer, and each discharge was followed by loud and sometimes rattling reports, whose reverberations rolled through the heavens in an endless procession of majestic and terrific sounds. During this scene, the moon, which was about half an hour above the western horizon, was visible, but so magnified, through the haze and vapor, as to appear like a brilliant flame suspended in the sky. For a period of twenty minutes the scene was one of grandeur and sublimity rarely witnessed.

In the States of Illinois and Iowa, and the prairie country west of the Mississippi river, thunderstorms are generally more terrific, and more lives have been lost there from the effects of lightning than in any other section of this country. Owing to the said country being level and devoid of trees, the equilibrium between the electricity of the atmosphere and that of the earth is principally restored by disruptive discharges.—*Spang's "Treatise on Lightning Protection."*

A TOOTH of a mastodon has been dug up near the Ashley river in South Carolina. It is 11¼ inches long, 6 inches in diameter, and weighs more than 5 lbs.

The Sea Serpent Sighted from a Royal Yacht.

The Osborne, paddle royal yacht, Commander Hugh L. Pearson, which arrived at Portsmouth from the Mediterranean on Monday, June 11, has forwarded an official report to the Admiralty, through the Commander-in-Chief (Admiral Sir George Elliot, K.C.B.), respecting a sea monster which she encountered during her homeward voyage.

At about 5 o'clock in the afternoon of June 2, the sea being exceptionally calm, while the yacht was proceeding round the north coast of Sicily toward Cape Vito, the officer on the watch observed a long ridge of fins, each about 6 feet long, moving slowly along. He called for a telescope, and was at once joined by other officers. The Osborne was steaming westward at ten and a half knots an hour, and having a long passage before her, could not stay to make minute observations. The fins were progressing in an eastwardly direction, and as the vessel more nearly approached them, they were replaced by the foremost part of a gigantic monster. Its skin was, so far as it could be seen, altogether devoid of scales, appearing rather to resemble in sleekness that of a seal.

The head was bullet-shaped, with an elongated termination, being somewhat similar in form to that of a seal, and was about six feet in diameter. Its features were only seen by one officer, who described them as like those of an alligator. The neck was comparatively narrow, but so much of the body as could be seen, developed in form like that of a gigantic turtle, and from each side extended two fins, about fifteen feet in length, by which the monster paddled itself along after the fashion of a turtle.

The appearance of the monster is accounted for by a submarine volcano, which occurred north of Galita, in the Gulf of Tunis, about the middle of May, and was reported at the time by a steamer which was struck by a detached fragment of submarine rock. The disturbance below water, it is thought probable, may have driven up the monster from its "native element," as the site of the eruption is only one hundred miles from where it was reported to have been seen.—*Portsmouth (Eng.) Times.*

Sunstroke.

The sudden accession of heat has already produced one fatal, and more than one severe, case of sunstroke in the metropolis. Probably the affection so designated is not the malady to which the term *coup de soleil* can be properly applied. The condition brought about is an exaggerated form of the disturbance occasioned by entering too suddenly the "hot" room of a Turkish bath. The skin does not immediately perform its function as an evaporating and therefore cooling surface, and an acute febrile state of the organism is established, with a disturbed balance of circulation, and more or less cerebral irritation as a prominent feature of the complaint. Death may suddenly occur at the outset of the complaint, as it has happened in a Turkish bath, where the subject labors under some predisposition to apoplexy, or has a weak or diseased heart. It should suffice to point out the danger and to explain, by way of warning, that although the degrees of heat registered by the thermometer, or the power of the sun's rays, do not seem to suggest especial caution, all sudden changes from a low to a high temperature are attended with danger to weak organisms. The avoidance of undue exercise—for example, persistent trotting or cantering up and down the Row—is an obvious precaution on days marked by a relatively, if not absolutely, high temperature. We direct attention to this matter because it is obvious the peculiar peril of overheating the body by exertion on the first burst of fine weather is not generally realized. It is forgotten that the increased temperature must be measured by the elevation which has recently taken place, not the number of degrees of heat at present recorded. The registered temperature may be more or less than that which occurred a year ago; but its immediate effects on the organism will be determined by the conditions which have preceded it and the violence of the change.—*Lancet.*

Dead Horses Standing Erect.

The Danville *Advertiser* of the 7th inst. says: Mr. Smith was in town on Saturday with his hired man, and the two tell a singular story about a lightning stroke. Mr. Smith was on a grain drill in a field, and his hired man was about 12 rods from him, dragging. Suddenly Smith heard the noise of thunder, and became unconscious. The man also heard the noise, but neither of them saw any flash of lightning. The man went to Smith, and in about twenty minutes he was restored to consciousness. Then attention was given to the horses. One of them was standing erect, with one foot lifted a little way from the earth, and the other was kneeling with his nose in the earth, and both were stone dead, and retained their positions until they were pushed over. The supposition is that in this case the electricity went from the earth to the sky.

THE Berlin correspondent of the London *Times* states that General Berdan, of the United States, has invented an instrument which will greatly improve the art of killing. He calls his invention a "range-finder." It consists of a telescope and other instruments, all of which can be carried on a dogcart, and which enable the engineers to measure with perfect accuracy up to 2,000 metres, or 1,500 yards. The time needed to ascertain distances, is only two minutes, and the General believes that his invention will double the accuracy of artillery fire, and quadruple that of infantry.

SETTING LOCOMOTIVE SLIDE VALVES.

BY JOSHUA ROSE.

E. G. asks: "How can I set the slide valves of a locomotive when she is on the road?" J. H. S. asks: "What is the method of setting locomotive slide valves from marks on the slide spindle?" And F. O. asks: "How are the valves of inside cylinder locomotives set, since the back ports are out of sight and you cannot measure the lead?"

Our correspondent will find these questions answered in full below.

It is presumed that the lengths of the eccentric rod, reverse rod, and other parts are correct, and they are properly connected and oiled so as to be in working order. The first thing to do is to place the reverse lever in the forward full-gear notch of the quadrants, or sectors, as they are sometimes called. The next procedure is to place the crank on its forward dead center as near as can be ascertained by the eye, and loosening the set screw of the forward eccentric, that is to say, the eccentric which connects with the upper end of the link, move that eccentric round on the shaft until the valve leaves the port at the front end of the cylinder open to the amount of whatever lead it is desired to give the valve. In moving the eccentric round on the shaft, it is necessary to move it in the direction in which it will turn when in operation. This is done in order to take up any lost motion there may be in the eccentric straps, in the eccentric rod eyebolts, or other working parts or joints between the eccentric and the slide valve rod or spindle. If the eccentric was turned backwark instead of forward, all the lost motion would operate to vitiate the set of the valve, because, when the eccentric begins to move, its motion will have no effect in moving the slide valve spindle, until all the lost motion in the various parts is taken up by the eccentric movement. In considering this part of the operation, we must bear in mind that, to set the valve, we must move the wheels of the engine, it being impracticable to move the piston itself. Now, in moving the wheels, we are confronted with the fact that the crank pin is pulling the connecting rod; hence, if there is any lost motion in the brasses at either end of the connecting rod, the piston will not be at the end of its stroke when the crank is on its dead center.

Suppose, for instance, that we have moved the driving wheel forward until the crank stands upright at a right angle to the bore of the cylinder, the resistance to motion of the piston and crosshead has caused the crank pin to bed against the half-brass nearest to the cylinder, all the play or lost motion is then between the other half-brass and the crank pin. When, however, the engine is at work and the piston is driving the crank pin, instead of being driven by it, the lost motion will exist between the crank pin and the half-brass nearest to the cylinder, and the contact will exist between the crank pin and the other brass. The difference in the position of the piston, caused by this lost motion, may be ascertained by moving the piston back and forth until the crank pin contacts with first one and then the other half-brass. It is sometimes attempted to remedy the defect due to this lost motion by moving the crank pin past the dead center and then moving it back to the dead center, so that while on that center the play or lost motion in the connecting rod is taken up. This is all very well so far as the connecting rod and piston is concerned, and will cause them both to stand on their respective dead centers with the lost motion taken up; but, in moving the wheel back to the dead center, we have given full liberty to all the lost motion in the various parts of the valve motion or gear, as already explained, in reference to moving the eccentric upon the shaft. As there are so many more parts in the valve gear, in which lost motion may occur, it is manifestly preferable to take up that play by moving the driving wheel in a continuous direction, rather than to move the latter back to accommodate any play there may be in the connecting rod.

The crank being placed by the eye upon its forward dead center, and the eccentric connected to the top of the link being moved round on the axle (in the direction in which the wheels will run when the engine is going forward) until the steam port at the front end of the cylinder is open to the amount of the lead, we fasten the eccentric to hold in that position. We then throw the reverse lever over into the last notch at the other end of the sector, lifting the link up so that the eccentric connected to the lower end of the link may be approximately adjusted, which is done by moving the eccentric round upon the axle (in the direction in which the axle will revolve when the engine is running backward) until the crank stands upon the same dead center, and the front port is open to the amount of the lead. This being done, we have the eccentrics approximately adjusted and may proceed to the final adjustment, in which the first thing to do is to find the exact dead centers of the crank. It is obvious that a line drawn through the center of the crank pin and the center of the wheel axle, will stand horizontally true and level when the crank is on either of the dead centers, but the presence of the crank pin makes it impracticable to draw such a line. We can therefore draw one which will be parallel to those centers; and to do this we draw a circle upon the end of the wheel axle (and from its center) of the same diameter as that of the crank pin, and then resting a straight-edge upon the bearing of the crank pin (taking care to avoid the round corner upon the pin, if there is one), we place the other end of the straight-edge even with the top of the circle drawn upon the axle; and then, using the straight-edge as a guide, we draw a line across the end of the axle and the wheel face. When this line is level the crank will be upon its dead center. This plan is sometimes employed, but is not a very accurate one, because the length of the line is very short as compared to the circumference of the driving wheel; hence, an error of the thickness of the line becomes one equal to several thicknesses of the line when carried out to the wheel circumference. Furthermore, if the line of the cylinder does not stand horizontally level, as is sometimes the case, the result of the whole proceeding will be inaccurate. Again, the connecting rod end and the coupling rod is in the way, rendering it awkward to both draw and level the line.

A better and more accurate method to find the dead centers is as follows: Place the reverse lever into the end notch of the sector at the forward end, and then move the driving wheel forward until the guide block is within about a quarter of an inch of the end of its travel, then place a straight-edge against the end of the guide block, and draw, on the outside face of the guide bar, a line even with the end of the guide block. Bend a piece of wire (pointed at both ends) to a right angle, make a center punch mark either in the rail, under the driving wheel, or in some stationary, solid part contiguous to the wheel, or at such distance from it that when one end of the bent wire is placed in the center punch mark, the operator with the other end will be able to draw a line across the rim of the driving wheel. Here, however, arises another consideration, that it is better to set the valves with the wheel axle in its proper position in the pedestal shoes, and in order to do this the wheel should rest upon the rail with its proper proportion of the weight of the engine resting upon it. The springs will then be deflected to their proper amount, and the axle box will have passed its proper distance up the pedestals. It is obvious that if the engine is blocked up so that the driving wheels clear the rails (which is done in order to avoid having the weight of the engine to move while setting the valve), the axle boxes will drop in the pedestal and the valve will be set incorrectly, as the wheels are in a wrong position. To avoid this, and at the same time to avoid having to move the whole engine while setting the valve, the engine is blocked up from the rails, and the axle boxes of the driving wheels are wedged up so as to be lifted up into their proper position. In this case there is no very accurate means of ascertaining what is the exact proper height, save it be by first marking upon the outside faces of the shoes or pedestal a line even with the top of the axle box when the load is upon the wheels, and then, after blocking up the engine from the rails, wedging up the axle boxes till the face again comes even with the line.

Whatever plan is pursued, one end of the piece of wire is rested in the fixed center punch mark, and with the other a line is drawn across the outside face of the wheel rim. The driving wheel is then revolved forward until the guide block returns, having passed to the end of its travel. When its end again stands exactly even with the mark made upon the guide bar, the piece of wire is again brought into requisition, one end being rested in the fixed center punch mark as before, and with the other end another line is drawn across the outside rim of the wheel. It is obvious that by taking a pair of compasses and finding a point exactly equidistant between the two lines thus marked upon the wheel rim, and then marking that point with a center punch mark, the crank will be upon its exact dead center, when one end of the piece of bent wire rests in the fixed center punch mark, the other end rests in the center punch mark upon the wheel rim. To find the other dead center, the wheel must be moved about halfway round and the process repeated with the motion block at the other end of the guide bars.

Thus, whenever the piece of wire will stand with one end resting in the fixed center punch mark and the other end in either of the center punch marks upon the wheel run, the crank is upon a dead center. Having thus placed the crank upon either dead center, we measure the valve lead, and if in temporarily fixing our eccentrics we gave it too much lead, we mark where it stands upon the shaft by means of a line drawn on the axle and carried up on the side face of the eccentric; then move the eccentric back some little distance more than is necessary to make the adjustment, and then move it forward again a little at a time, noting when the valve has the proper amount of lead, and thus fasten the eccentric upon the axle by means of the set screw.

The object of moving the eccentric too far back and then moving it forward is to make the adjustment so that the latter may be made with the lost motion of the valve gear all taken up. The next proceeding is to move the driving wheel halfway round and try the lead at that end of the stroke. If the lead at the two ends is not equal, it shows that either the slide valve spindle or the eccentric rods are not of the proper length and must be rectified; this being done, the crank must be again placed upon first one and then the other dead center, the valve lead being measured at each end. When the lead is equal at each end, the rods are of correct length, and the amount of the lead must be regulated by moving the eccentrics as already directed.

If the link block does not come opposite the end of the eccentric rod when the reverse lever is in the end notch of the sector, the length of the reverse rod is wrong and should be corrected. If the link block comes right, under the above conditions, for the forward but not for the backward eccentric rod, the notches in the sector are not cut in their proper positions, or the link hanger is not of the proper length. In either case the error may be remedied by altering the length of the latter. But, as doing this would alter the amount of the valve lead, it is well, if there is any prospect of such errors, to correct them before setting the valves.

Instead of measuring the lead of the valve with a rule, or by a wedge, the following plan is very often adopted: After the valve and spindle are in position, the valve is placed with the proper amount of lead upon the front port. A center punch mark is then made upon the face of the steam chest. A piece of quarter inch iron wire is then bent at right angles and each end filed to a point. One end of this wire is placed in the fixed center punch mark in the steam chest, and with the other a mark is made upon the slide spindle. Upon this latter mark a center punch mark is also made sufficiently deep to be very plainly visible when the burr raised by center punching is filed off, which is necessary to prevent this burr from cutting the packing. It follows that whenever the bent piece of wire will rest with one end in the center punch mark in the steam chest, and the other end in the center punch mark in the slide spindle, the valve is in its proper position when the crank is on the corresponding dead center. This plan is a very old one and possesses the advantage that the valve may be set without seeing it, that is to say, with the steam chest cover on. If the length of the piece of wire measured direct from point to point is known, the valve may be set when the engine is upon the road without taking off the steam chest cover. The center punch mark upon the steam chest should, however, always be placed in about the same spot, so as to avoid mistakes in case of there being other similar marks upon the chest. It should always be made deep, so as not to get filled up with paint and be difficult to find. In course of time the mark upon the slide valve spindle is apt to disappear from the wear of the spindle, hence the center punch with which it is made should have a long conical point. To mark the position of the eccentric upon the axle, it is an excellent plan, after the eccentrics are finally adjusted, to take a chisel with the cutting end ground to the form of a fiddle drill, one cutting edge being at a right angle to the other. The chisel must be held so that while one edge rests upon the axle, the other edge will bear against the radial face of the eccentric. A sharp blow with a hammer upon the chisel-head will make a clean indented cut upon the axle and the eccentric, the two cuts exactly meeting at their junction and denoting the position of the eccentrics. In setting the valves of inside cylinder locomotives, the back ports being out of sight, the amount of lead is ascertained by making a wooden wedge about three inches long, a thirty-second of an inch thick at one end and three eighths of an inch thick at the other end. The faces of this wedge are chalked, and the lead is measured by inserting it between the edge of the valve and the edge of the port until its thickness just fills the space, and then moving it edgeways so that the valve and port edges will just mark it. By measuring the thickness of the wedge at the mark, the amount of lead is ascertained. After the valves are set, it is still desirable to mark the position by center punch marks upon the outside of the steam chests and upon the valve spindles, as already described.

If an eccentric should slip when the engine is upon the road, and there are no marks whereby to readjust them, it may be done approximately as follows: Put the reverse lever in the end notch of the forward gear, then place the crank as nearly on a dead center as the eye will direct, and open both the cylinder cocks, then disconnect the slide valve spindle from the rocker arm, and move the valve spindle until the opening of the port corresponding to the dead center on which the crank stands will be shown by steam blowing through the cylinder cock, the throttle valve being opened a trifle. The position of the valve being thus determined, the eccentric must be moved upon the shaft until the valve spindle will connect with the rocker arm without being moved at all. The throttle valve should be very slightly opened, otherwise so much steam will be admitted into the cylinder that it will pass through any leak in the piston and blow through both cylinder cocks before there is time to ascertain which cock gives first exit to the steam.

New Steamer.

A new steamer for the Mallory line, between New York and Texas, was lately launched from the yard of Roach & Co., Chester, Pa., 2,200 tons burden. Principal dimensions as follows: Length over all, 239 feet 7 inches; beam (moulded), 34 feet; depth from the base to the spar deck beams, 18 feet 2½ inches; depth of hold, 16 feet 5½ inches; diameter of propeller (Hirsch's patent—four blades), 11 feet 6 inches. She is to be provided with compound engines, having cylinders 24 and 44 inches in diameter, with a stroke of 44 inches, and two return tubular boilers 10 feet long, 10 feet 3 inches wide, and 8 feet 6 inches high. Aft are compartments capable of holding 80 tons of water, for the purpose of depressing the stern before and after crossing the bar at Corpus Christi. Her low draught is 7½ feet; speed, 14 knots.

A Tin-Can Telephone.

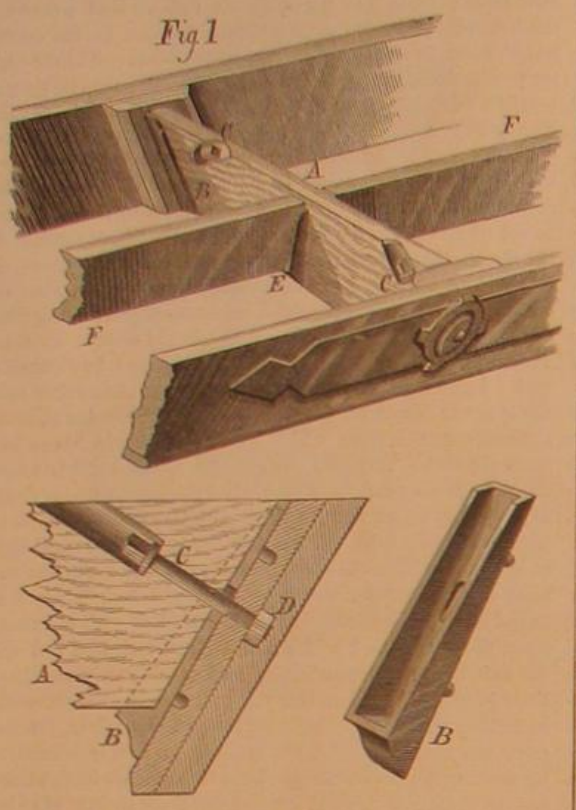
In Professor Bell's telephone a plate of sheet iron is made to vibrate by means of the electrical current, something after the manner of the skin of a drumhead. In a recent improvement by Mr. G. B. Havens, Louisville, Ky., the electrical wires are wrapped around a common tin fruit can. By means of tin cans at each end, sounds, it is said, were sent over 93 miles of wire, and included several pieces of music.

MR. HOTCHKISS, an American inventor, whose improved revolving cannon we illustrated some time since, has received intimation that his system has been approved by the French Government, and that they have decided to adopt his cannon.

COLLENDER'S IMPROVED BILLIARD TABLE.

In the accompanying engravings, we illustrate two important improvements in the construction of billiard tables, which have recently been devised by Mr. H. W. Collender, the well known billiard table manufacturer of this city. The first, which is represented in Fig. 1, relates to the construction of the bed-supporting frame, and aims to render the same stronger while cheapening its manufacture. In putting together the body and framework of the table, the usual practice is to cut away the stock of the cross beam and longitudinal beam, and halve them together. Longitudinal grooves are also formed on the inner surface of the *side* and

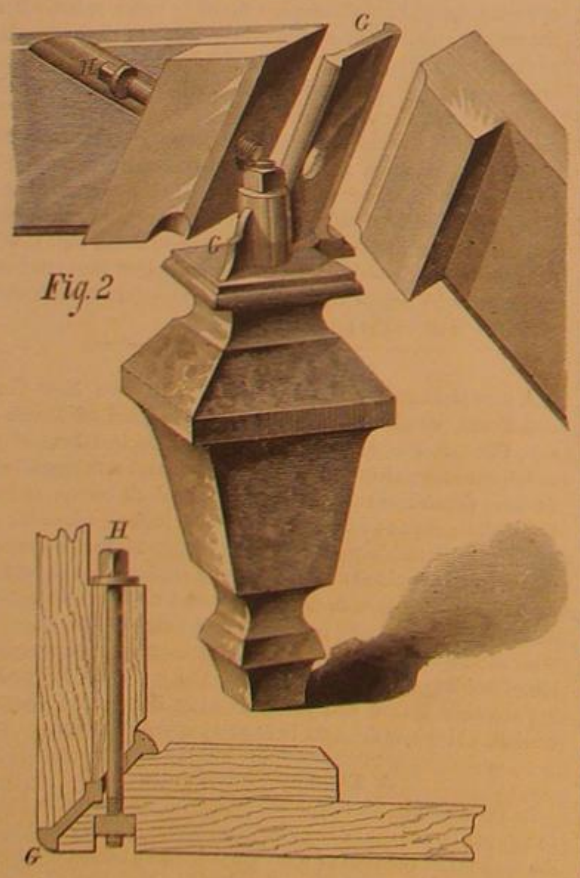
Fig. 1



"broad rails," to accommodate tenons on the ends of the cross beams; and the latter are secured in place by bolts fastening their ends to the broad rails. Mr. Collender claims that, by this mode of construction, not only are the cross beams weakened by being halved together, but the broad rails are also weakened by the cutting away of this stock near the middle to effect the framing into them of the ends of the cross beams.

From Fig. 1, it will be seen that the cross beam, A, is combined with the side broad rails in the following manner: Upon the inner face of each broad rail is secured a cast iron

Fig. 2



socket piece, B, into which fits one end of the cross beam, A. From said beam the bolt, C, passes through the shoe, B, and is secured by a nut, D, let into the stock of the broad rail. The shoe, B, has lugs which enter the broad rail; and the aperture in it, through which the bolt passes, is made oblong to admit of the drawing of the parts together after the insertion of the bolt. Upon the sides of the cross beam near the middle, and directly opposite each other, are two shoes, E; these have no bolt holes. In them are placed the adjacent ends of the longitudinal beams, F, the other extremities of which are seated in shoes on the broad rails. The shoes, E, have their lugs of such a length, compared with the thickness of cross beam, A, that when put in place on said beam said lugs will come together. The advantage of this is that, should the beam, A, shrink in width, the shoes on each side of it will still maintain their proper relation to form immovable abutments for the ends of pieces, F. This construction allows of shorter stuff being used in the manufacture, and renders the framework stronger.

In Fig. 2 is illustrated a new method of forming the corners of the table. Hitherto it has been customary to use corner blocks, of various sizes according to the dimensions of the table, located one at each corner. Into these the broad rails were framed and secured. To this arrangement Mr. Collender adduces a long category of objections, based on the possibility of the weight of the bed being thrown on these blocks in case of shrinkage of the frame, on the fact that the corner of the table bed must necessarily be left without any support where it extends over the upper end of the corner block, and also that in a bevel table, in which the area of the top of the corner block is unavoidably much greater than that of the top of the corner block of a vertical-sided table, a large portion of the table bed will be left without any support.

The new device consists of a cast iron union plate, G, which is bolted to the leg as shown. The broad rails and casting are securely fastened by the bolt, H. It will be seen that this bolt, passing through the end of one broad rail, and into a nut let into the other rail, will securely draw and hold together the ends of said rails and the interposed metal plate clamped between them, and that as the plain ends of the wooden rails just fit (widthwise) between the projecting heads on the edges of said interposed plate, the latter will form a sort of housing for the ends of the rails. And it will be understood that in this construction not only does the bead on the outer edge of the plate overlap the edges of the rails and form a neat and durable corner finish to the body, but the broad rails being bolted together in the direction of the grain of the wood with only an interposed metal plate, there will be no tendency to a loosening of the union of the parts of the frame. The main importance of this invention rests in the idea of dispensing with the usual corner blocks, and thus permitting the top edges of the broad rails, on which the bed rests, to practically come together and afford a perfect support to the bed clear out to the corners of the latter; at the same time the whole structure is rendered stronger and more durable with less weight of material.

These inventions are the subject of separate patents, that of the first being dated April 4, 1876, and of the second, November 16, 1875. For further information, address the manufacturer and patentee, Mr. H. W. Collender, 738 Broadway, New York city.

Coating Engraved Copper Plates with Steel.

In order to render copper plates which are used in printing more durable, they can be covered with an electrolytic deposit of iron which possesses an unusual degree of hardness almost superior to steel. The salt usually employed has been the double sulphate of iron and ammonia. Professor Böttger, who first invented this process, has recently devised an improvement in the bath employed. He dissolves 10 parts of ferrocyanide of potassium (yellow prussiate of potash) and 20 parts of the double tartrate of soda and potash (Rochelle salts) in 200 parts of water, and to this he adds 3 parts of persulphate of iron dissolved in 50 parts of water. A large precipitate of Prussian blue is formed. To the whole is added, drop by drop, with constant stirring, a solution of caustic soda until the blue precipitate entirely disappears, leaving a perfectly clear, light yellow liquid, which is now ready for use.

Professor Böttger also claims that this solution can be employed with advantage for dyeing cotton yarn and fabrics a beautiful blue, without the use of a mordant. For this purpose the goods are put into the bath, that has previously been slightly warmed, until they are saturated through and through, and then dried in the air, after which they are immersed in extremely dilute sulphuric acid (1 to 50), which neutralizes the alkali, and after washing and drying again they are permanently dyed a fine blue color.

Test for Sulphur in Organic Compounds.

H. Vohl recommends the following as the best method of detecting sulphur in organic compounds: The substance to be tested is heated in a solution of caustic lime and oxide of lead in glycerin. The latter is prepared as follows: One volume of distilled water is mixed with 2 volumes of pure glycerin and heated to boiling; freshly prepared slaked lime is added, little by little, until it is saturated. Freshly precipitated hydrated oxide of lead, or moist litharge, is added in excess, and the liquid allowed to boil gently for a few minutes, then tightly corked and left to cool, after which the clear liquid is decanted from the sediment into a glass vessel that can be tightly corked.

If into this solution be introduced and heated any organic which contains sulphur, like hair, feathers, horn, albumen, and the like, it will at once turn black from the formation of sulphide of lead. The great delicacy of this test is evident from the fact that, when pure wheat bread is boiled with this reagent, it turns yellow at first and then dark gray in consequence of the presence of sulphur in the gluten of the bread.

IMPROVED BILLIARD BALL HOLDER.

The usual receptacle for the fourth ball, when only three balls are used in the game of billiards, is placed at the side of the table. As this is both inconvenient and unsightly, a neat device, clearly shown in the annexed illustration, has



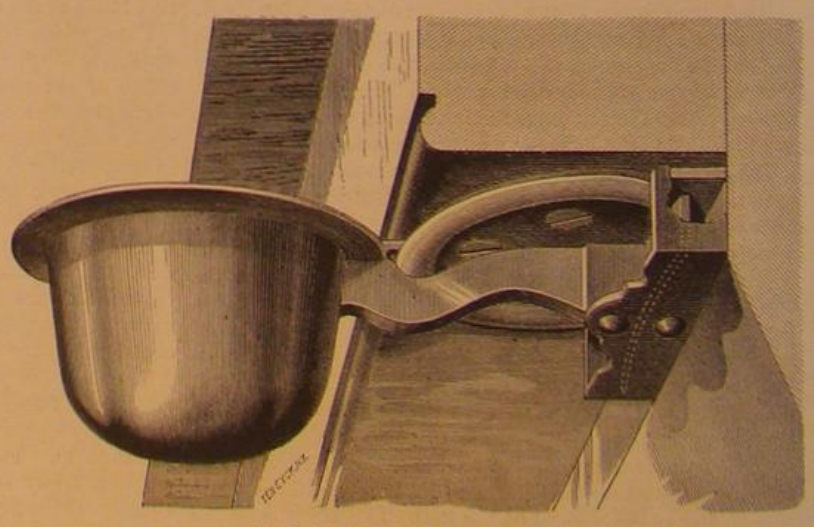
been invented, which is intended to be attached to a gas fixture over the table. A plate or sign is also added on which the number of a table—in case several tables are employed, as in a billiard saloon—may be inscribed. The form and design of the arrangement may of course be varied in many ways.

Patented May 2, 1876. For further particulars, address the manufacturer, Mr. H. W. Collender, 738 Broadway, New York city.

THE MONITOR CHALK CUP.

The annexed engraving represents an improved chalk cup or holder for billiard tables, which is so constructed that it will not become loose, sag down, mar the table, or jar when the ball strikes the cushion. It may be adjusted to remain in any desired position.

The shank is pivoted in a metallic frame which is secured



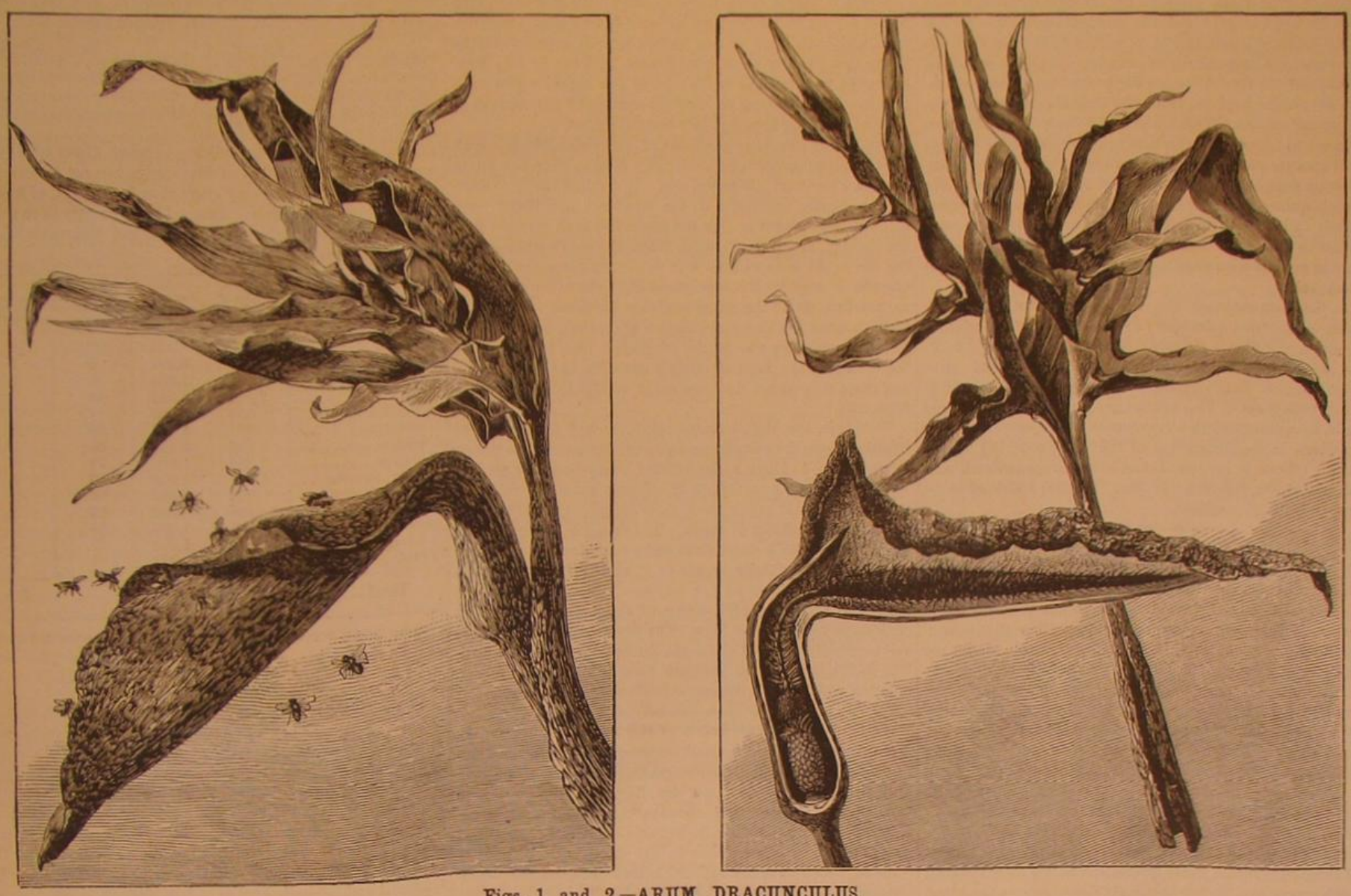
THE MONITOR CHALK CUP.

to the table. The rear end of the shank works against a spring. On the upper portion of the shank is a projection which embraces a horizontal flange to sustain the box against being forced downward. The arrangement is very similar to the ordinary window catch. The player has only to start the box from its position under the table, when the spring carries it out at right angles to the rail. A touch is sufficient to cause the spring to carry the box back to its former position. The device is very simple, and its advantages will be evident to all billiard players cognizant of the defects of the ordinary cup.

Patented May 1, 1877. For further particulars, address the manufacturer and patentee, Mr. H. W. Collender, 738 Broadway, New York city.

CURIOUS CARNIVOROUS PLANTS.

The *arum Dracunculus* is one of the most curious of that wonderful series of carnivorous plants which at the present time are engaging the closest scrutiny of naturalists. It is a true trap in one sense—inasmuch as it captures the victim which ventures near it; but it relies on little or no mechanical means for securing its prey, but stupefies the living insect by its odor. The flower is horn-shaped, about 11 inches in length, with an opening some 5 inches in diameter. The color within is a dull dark violet, while the interior of the spathe is lined with black, hooked bristles, the whole appearance of the flower being thoroughly repulsive. The illustrations herewith presented, Figs. 1 and 2, represent it at one third its natural size, Fig. 2 showing a section of the flower. It is not certain what attracts the insects, which are usually of the species known as the meat fly and the common house fly. They do not seem to seek for the small quantity of nectar concealed, and yet they cluster about the fatal opening, as if drawn by some overpowering fascination. Overcome by lethargy, they fall inert upon the flower, are lightly held by the bristles, and finally die asphyxiated by the carbonic acid which the plant disengages in large quantities during its inflorescence. Strange as is the action of the *arum*, the method whereby the *mentzelia* takes its prey is even more wonderful. To illustrate on a magnified scale, let the reader imagine a surface thickly covered with strong iron posts, on the sides of which are numerous keen barbs pointing downward. Then between these posts, suppose that jars overflowing with honey are placed. An elephant, let it be imagined, attracted by the profusion of sweetness, inserts his trunk between the posts and finds easy access to the honey. But while he can force his proboscis downward past the barbs turned in that



Figs. 1 and 2.—ARUM DRACUNCULUS.



Fig. 3.—MENTZELIA.



Fig. 4.—GRONOVIA SCANDENS.

direction, when he attempts to withdraw it he finds the keen points catch in the flesh, and render it impossible to do so. A terrible struggle follows, the unfortunate animal twisting and writhing in every direction, until finally by an Herculean effort the head is torn from the body, and the latter becomes digested by some potent gastric juice, exuding from the colossal organism of which the trap forms but a portion. Of course this is vastly exaggerated, and it would puzzle an elephant to pull his own head off; but if for the post studded trap, we substitute the surface of a flower, and if we replace the elephant by a fly, we shall have conceived an accurate picture of what takes place in the peculiar receptacle with which Nature has provided the *mentzelia ornata*. This is very beautifully shown in Fig. 3; and at A, in same figure, is represented the barbed bristles grasping the highly magnified proboscis of the fly. Between the barbed bristles are mush-room-shaped projections, from the summits of which a viscous nectar exudes. This is the honey bait which induces the insect to insert his trunk between the fatal barbs. There is still another plant, *physianthus albens*, which captures butterflies by grasping the proboscis. The construction of the flower is quite complicated, so that the insects are compelled to insert their trunks through a narrow and winding passage in order to reach the nectar. The organ then necessarily comes in contact with an adhesive substance, which prevents its removal.

The *Gronovia scandens*, Fig. 4, is another plant trap, which catches no flies nor possesses any such wonderfully adapted devices as the plants already described. It simply has its branches covered with double barbed bristles of great strength which attach themselves to anything brought in contact with them. The bristles are strong enough to hold lizards, as represented by our engraving, the points inserting themselves in the interstices of the scaly covering of the reptile. Of course the lizard thus held starves to death, and small birds often follow a like fate. We are indebted to *La Nature* for the illustrations.

Popular Fallacies.

Night air and damp weather are held in great horror by multitudes of persons who are sickly or of weak constitutions; consequently, by avoiding the night air, and damp weather, and changeable weather, and weather that is considered too hot or too cold, they are kept within doors the much largest portion of their time, and as a matter of course continue invalids, more and more ripening for the grave every hour; the reason is, they are breathing an impure atmosphere nineteen-twentieths of their whole existence.

As nothing can wash us clean but pure water, so nothing can cleanse the blood, nothing can make health-giving blood, but the agency of pure air. So great is the tendency of the blood to become impure in consequence of waste and useless matters mixing with it as it passes through the body, that it requires a hogshead of air every hour of our lives to unload it of these impurities; but in proportion as this air is vitiated, in such proportion does it infallably fail to relieve the blood of these impurities, and impure blood is the foundation of all disease. The great fact that those who are out of doors most, summer and winter, day and night, rain or shine, have the best health the world over, does of itself falsify the general impression that night air or any other out-door air is unhealthy as compared with in-door air at the same time.

Air is the great necessity of life; so much so, that if deprived of it for a moment, we perish; and so constant is the necessity of the blood for contact with the atmosphere, that every drop in the body is exposed to the air through the medium of the lungs every two minutes and a half of our existence.

Whatever may be the impurity of the out-door air of any locality, the in-door air of that locality is still more impure, because of the dust, and decaying and odoriferous matters which are found in all dwellings. Besides, how can in-door air be more healthy than the out-door air, other things being equal, when the dwelling is supplied with air from without?

To this very general law there is one exception, which it is of the highest importance to note. When the days are hot, and the nights cool, there are periods of time within each twenty-four hours, when it is safest to be in-doors, with doors and windows closed; that is to say, for the hour or two including sunrise and sunset, because about sunset the air cools, and the vapors which the heats of the day have caused to ascend far above us, condense and settle near the surface of the earth, so as to be breathed by the inhabitants; as the night grows colder, these vapors sink lower, and are within a foot or two of the earth, so they are not breathed. As the sun rises, these same vapors are warmed, and begin to ascend, to be breathed again, but as the air becomes warmer, they are carried so far above our heads as to be innocuous. Thus it is that the old citizens of Charleston, S. C., remember, that while it was considered important to live in the country during the summer, the common observation of the people originated the custom of riding into town, not in the cool of the evening or of the morning, but in the middle of the day. They did not understand the philosophy, but they observed the fact that those who came to the city at mid-day remained well, while those who did so early or late suffered from it.

All strangers at Rome are cautioned not to cross the Pontine marshes after the heat of the day is over. Sixteen of a ship's crew, touching at one of the West India islands, slept on shore several nights, and thirteen of them died of yellow fever in a few days, while of two hundred and eighty, who were freely ashore during the day, not a single case of illness occurred. The marshes above named are crossed in six or eight hours, and many travelers who do it in the night are attacked with mortal fevers. This does, at first sight, seem to indicate that night air *is* unwholesome, at least *in* the locality of virulent malarias, but there is no direct proof that the air about sunrise and sunset is not that which is productive of the mischief.

For the sake of eliciting the observations of intelligent men, we present our theory on this subject.

A person might cross these marshes with impunity, who would set out on his journey an hour or two after sundown, and finish it an hour or two before sun-up, especially if he began that journey on a hearty meal, because, in this way, he would be traveling in the cool of the night, which coolness keeps the malaria so near the surface of the earth as to prevent its being breathed to a hurtful extent.

But if it is deadly to sleep out of doors all night in a malarial locality, would it be necessarily fatal to sleep in a house in such a locality? It would not. It would be safer to sleep in the house, especially if the windows and doors were closed. The reason is, that the house has been warmed during the day, and if kept closed, it remains much warmer during the night indoors than it is outdoors; consequently, the malaria is kept by this warmth so high above the head, and so rarefied, as to be comparatively harmless. This may seem to some too nice a distinction altogether, but it will be found throughout the world of Nature that the works of the Almighty are most strikingly beautiful in their *minutæ*, and these *minutæ* are the foundation of His mightiest manifestations.

Thus it is, too, that what we call fever and ague might be banished from the country as a general disease, if two things were done. 1. Have a fire kindled every morning at daylight, from spring to fall, in the family room, to which all the family should repair from their chambers, and there remain until breakfast is taken. 2. Let a fire be kindled in the family room a short time before sundown; let every member of the family repair to it, and there remain until supper is taken.

In both cases, the philosophy of the course marked out consists in two things. First. The fire rarefies the malaria and causes it to ascend above the breathing point. Second. The food taken into the stomach creates an activity of circulation which repels disease.—*Hall's Journal of Health.*

The Extension of the Plague.

Our recent English medical exchanges mention, with undisguised apprehension, the fact that already early this spring authentic observers state that the plague has broken out in Bagdad, and is rapidly increasing there; and information from other sources renders it probable that the disease has shown itself in other places in the vicinity of that city, some of which have not suffered before since the new development of the disease in Mesopotamia, three or four years ago. The progress of the epidemic in and about Bagdad last year shows that each year since its reappearance in that district it has covered a wider area, and it will be remembered that last year it crossed the Turco-Persian frontier, and broke out at Shuster, in Khuzistan. From the phenomena of the epidemic to this period it was feared, especially by the physicians on the spot, that, if it should recur in the present year, it must be expected to extend over a still wider area, and show itself in even a more aggravated form than had yet been observed. This opinion is concurred in by Surgeon-Major Colville, the medical officer attached to the British Embassy at Bagdad, and is expressed in his official report, on the subject of the last and previous year's outbreak.

The Turco-Russian struggle in Asia Minor, and the massing of Persian troops on the western frontier of that country, add an additional and most grave factor to this ominous intelligence.

It has been so long since Christian Europe has suffered from this terrible disease that most medical men have never seen a case, and, indeed, for awhile, epidemiologists flattered themselves it had "died out." They yet say that a thorough system of sanitation will certainly check its advance.

Let us hope so; for of all pestilences which have ever scourged humanity, and desolated empires, none approach in magnitude those of the plague. Under the name of "the black death," it fills, as Hirsch remarks, one of the darkest pages in the history of the human race. It devastated every known country of the earth, and penetrated to the remotest mountain hamlets and granges, sometimes sweeping away in a few days every inhabitant, leaving not one to remember the name or to inherit the goods of the family or the village. Long years afterward, travelers would come upon these unknown villages, the houses rotting, the bones of the plague-stricken owners bleaching in the rooms and streets, and no one to say who they had been.

As an epidemic disease, it no doubt spreads from India, that mother of pestilence, where, in the province of Kutch and Guzerat, it is found as an endemic of great malignancy, Far more fatal in its historical appearance than the cholera, it is well that the medical mind of Europe is on the alert to meet its approach with the most energetic measures; and should they fail, it will devolve upon us to lose no time in taking up the defensive in the most energetic manner.—*Medical and Surgical Reporter.*

Education in Germany.

The compulsory school laws of Prussia are frequently pointed to as models for similar laws, perhaps with the hope that by imitating her lower schools we can bring up our high schools to an equal rank with hers, and place our universities on a level with those which are producing the most finished scholars, the deepest thinkers, and the greatest investigators. We are likely to forget that the conditions are different, and especially that *nascitur, non fit*, is as true of a chemist as of a poet. The state of popular education in Germany is, however, a matter of interest, and is best illustrated by the following table, showing the percentage of unschooled men among the recruits from different German provinces:

	Per cent.		Per cent.
Prussia	3·19	Hesse	0·35
Bavaria	1·79	Mecklenburg	1·09
Saxony	0·23	Thuringia	1·42
Würtemberg	0·02	Alsace	3·45
Baden	0·22		

These figures seem to indicate a higher grade of intelligence and wider diffusion of knowledge among all classes, for recruits are from every class, than in Austria, although in the latter the figures are arranged so differently as to make any accurate comparison of Austria and Germany rather difficult and unsatisfactory.

Name of District.	Number of Common Schools.	Number of Inhabitants to each School.	Percentage of school children who attend.	Number of Normal Schools.
Bohemia	4,190	1 254	77	12
Bukowina	167	3,121	9	1
Dalmatia	241	1,864	12	2
Galacia	2,374	2,341	15	1
Carinthia	318	1,060	?	2
Carniola	234	1,187	48	2
Custrin	396	1,496	38	5
Moravia	1,866	1,082	78	5
Lower Austria	1,267	1,578	76	5
Upper Austria	506	1,455	82	2
Salzburg	155	982	85	1
Steiermark	690	1,657	59	3
Schlesia	433	1,208	77	4
Tyrol	1,926	457	?	6
Total	14,763			51

Over 3,000 teachers' positions are said to be vacant at the present time.

Bleaching Silk and Wool.

The methods now in use for bleaching silk, wool, and all animal fibers, such as sulphurous acid, alkalies, soap, etc., are so imperfect that Tessié du Motay has patented the following process, involving the use of binoxide of barium, with or without the addition of permanganates. The binoxide of barium is pulverized and subjected to the action of carbonic acid to remove any unconverted caustic baryta present. It is then thrown into boiling water, and after the bath has partially cooled the materials to be bleached are introduced and the bath kept at a temperature of 86° Fah. to 194° Fah. for two hours; silk from wild silkworms requiring a higher temperature than wool, goat's hair, and the like. It is then taken out and washed, put into an acid bath, then washed again. If necessary, the barium bath is repeated, as also the subsequent washings. If this second bath of binoxide of barium does not produce the requisite whiteness, it is introduced into a solution of permanganic acid or permanganate of magnesia before the last washing.

Binoxide of Barium, $Ba O_2$, is made by subjecting the oxide or caustic baryta, Ba O, to a stream of oxygen or common air at a high temperature. Its bleaching action is probably due to the formation of peroxide of hydrogen in solution in the bath.

An Alloy of Tin and Phosphorus.

At the Graupen Tin Works, in Bohemia, an alloy of tin and phosphorus is made containing the greatest possible quantity of phosphorus which the tin is able to retain without losing any of it upon repeated meltings. This compound, ... is neither entitled to the name of alloy nor is it a phosphide of tin, is employed in the manufacture of phosphorus-bronze. In the manufacture of phosphorus-bronze, by alloying copper with phosphorus-tin, no other precautions require to be observed than in the preparation of common bronze. As the different properties of phosphorus-bronze depend upon the proportions of phosphorus and of tin, two kinds of phosphorus-tin are prepared. No. 0 contains 5 per cent, and No. 1, 2½ per cent of phosphorus. These two kinds suffice to make the greater part of all the desired mixtures. For special purposes, the Graupen Works make to order phosphorus-tin with any desired quantity of phosphorus not exceeding 5 per cent, which is the highest possible limit. It is claimed that phosphorus-bronze may be manufactured by the use of this phosphorus-tin as much as 40 per cent cheaper than that now in the market, while it will only cost 8 per cent more than the ordinary tin and copper bronze.

No details are given of the method employed to make the phosphorus combine with tin, but the low melting point of tin as compared with that of copper would indicate that this would lead to the great saving promised above.

American Institute Exhibition.

The forty-sixth Exhibition of this Institute will open September 12, in this city. Parties having novelties which they intend to bring to public notice should at once address the General Superintendent for blanks and information. The medals, it is said, have been increased and special awards will be made upon a number of articles

American Inventions for New South Wales.

Writing from Sydney, under date of April 14, the *Times* correspondent thus refers to the supply of locomotives and carriages from America: Our appearance at Philadelphia has drawn the attention of American manufacturers to us in a most marked and unexpected degree. A country that, like New South Wales, is rolling in wealth must be a country that is able to buy, and a country that is able to buy is exactly the country that American manufacturers have been anxiously looking out for. Our representatives at Philadelphia have come back strongly impressed with the fact that there are many things that the Americans can supply us with advantage. Our Government has an offer from Messrs. Baldwin & Co. to furnish a locomotive engine for about £1,000 less than the cost of an English engine, and to leave the payment open until the engine has been thoroughly proved and approved. A Pullman's sleeping car and an ordinary passenger car have already been ordered, and American wheels, axles, rails, and brakes are strongly pressed on our acceptance. As our Government engineers are all of the English school, American novelties will have a hard battle to fight to win official acceptance, but the demand for economy in railway construction and working is so great that people and Parliament will press on the Minister for Public Works a fair trial for any American novelties that may seem to be suited to our wants. The English manufacturers, therefore, who have hitherto supplied us must look to their laurels.—*Capital and Labor.*

Man's Place in Nature.

Concerning man's true place in Nature, Haeckel says:

"Whatever part of the body we consider, we find upon the most exact examination that man is more nearly related to the highest apes than are the latter to the lowest apes. It would therefore be wholly forced and unnatural to regard man in the zoological system as constituting a distinct order, and thus to separate him from the true ape. Rather is the scientific zoologist compelled, whether it is agreeable to him or not, to rank man within the order of the true ape (Simiæ)."

To whatever minutiæ of detail the comparison is carried, we reach in every case the same result. Between man and the anthropoid apes there are the closest anatomical and physiological resemblances. In form and function, there is the most exact agreement between all the corresponding bones of the skeleton of each; the same arrangement and structure of the muscles, nerves and entire viscera, and of the spleen, liver and lungs—the latter being a matter of especial significance, for between the manner of breathing and the process of nutrition there is the closest relation.

The brain, also, is subject to the same laws of development, and differs only with regard to size. The minute structure of the skin, nails, and even the hair, is identical in character. Although man has lost the greater part of his hairy covering, as Darwin thinks, in consequence of sexual selection, yet the rudimentary hairs upon the body correspond, in many respects, to those of the anthropoids. The formation of the beard is the same in both cases; while the face and ears remain bare. Anthropoids and men become grayhaired in old age. But the most remarkable circumstance is that, upon the upper arm, the hairs are, in both cases, directed downward, and upon the lower arm upward; while in the case of the half-apes it is different, and not as soft as that of man and the anthropoids.

The eye, on account of its delicate structure, is peculiarly suitable for comparisons of this kind; and we find here the greatest similarity: even inflammation and green cataract occur, under the same circumstances, in both. See, also, Darwin upon this point.

There is no more striking proof that man and the anthropoid apes have the same anatomical and physiological nature, and require the same food, than the similarity of their blood. Under the microscope the blood corpuscles are identical in form and appearance; while those of the carnivora are clearly different from them.

It may now be interesting, in confirmation of what has been said, to refer to the family life, and, if one may so speak, to the mental and moral life of the anthropoids. Like man, the ape provides with exceeding care for its young, so that its parental affection has become proverbial. Connubial fidelity is a general and well known virtue. The mother ape leads its young to the water, and washes its face and hands in spite of its crying. Wounds are also washed out with water. The ape, when in distress, will weep like a human being, and in a manner that is said to be very affecting. Young apes manifest the same tendencies as human children. When domesticated, they are in youth docile and teachable, and also, at times, like all children, disobedient. In old age they often become morose and capricious. Most apes construct huts, or, at least, roofs, as a protection from the weather, and sleep in a kind of bed.

One peculiarity is alone common to them and man, and this is the habit of lying upon the back in sleep. In battle they defend themselves with their fists and long sticks; and, under otherwise like circumstances, they manifest like passions and emotions with man: as joy and sorrow, pain and envy, revenge and sympathy. In death, especially, the ape face assumes a peculiarly human-like and spiritual expression, and the sufferer is the object of as genuine compassion as exists in the case of man. It is also well known that apes bury their dead, laying the body in a secluded spot, and covering it with leaves. Regarding the domestic life of the ape, Darwin says, in his "Descent of Man" (vol. 1, p. 39):

"We see maternal affection manifested in the most trifling details. Thus Rengger observed an American monkey (a Cebus) carefully driving away the flies which plagued her infant; and Duvancel saw a Hylobates washing the faces of her young ones in a stream. So intense is the grief of female monkeys for the loss of their young, that it invariably caused the death of certain kinds kept under confinement by Brehm in North Africa. Orphan monkeys are always adopted, and carefully guarded by other monkeys, both males and females. One female baboon had so capacious a heart, that she not only adopted young monkeys of other species but stole young dogs and cats, which she continually carried about with her. Her kindness did not go so far, however, as to share her food with her adopted offspring; at which Brehm was surprised, as his monkeys divided everything quite fairly with their own young ones. An adopted kitten scratched the above-mentioned affectionate baboon, who certainly had a fine intellect, for she was much astonished at being scratched, and immediately examined the kitten's feet, and without more ado bit off the claws."

The number of characteristics possessed in common by man and the higher apes is, indeed, very great, and includes not only physical and emotional but even intellectual qualities.—*From Schlickeysen's "Fruit and Bread," translated by Dr. Holbrook.*

Special Notice.

Persons who have sent numbers of the SCIENTIFIC AMERICAN to this office, for the purpose of having them bound, will please call or send for them immediately.

Some of the volumes extend back to 1860, and as we need the room they occupy, we shall dispose of those not claimed within ten days from date of this paper.

MUNN & Co., 37 Park Row, New York.

DECISIONS OF THE COURTS.

United States Circuit Court.—District of New Jersey.

SHAWL STRAP PATENT.—GEORGE CROUCH *vs.* WILLIAM ROEMER.

[In equity.]

By Nixon, District Judge.

This is an action for an alleged infringement of complainant's letters patent No. 82,606, dated September 29, 1868, and reissued March 7, 1871, No. 4,289.

The subject-matter of the patent is in the reissue described to be a strap "to confine a shawl or similar article in a bundle," and termed a shawl-strap. The schedule attached to and forming a part of the said reissued patent states, that before the complainant's invention "straps had been used to confine a shawl or similar article in a bundle, and a leather cross-piece with loops at the ends, had extended from one strap to the other; and above and attached to this leather cross-piece was a handle. This leather cross-piece or connecting strap is liable to bend and allow the straps to be drawn toward each other by the handle in sustaining the weight. Hence the bundle is not kept in a proper shape and the handle is inconvenient to grasp."

The invention is then stated to consist "of a rigid cross-bar beneath the handle, combined with suspending straps, that are to be passed around the shawl or bundle, such straps passing through loops at the ends of the handle."

No question can be made but that the shawl straps manufactured and sold by the defendant are an infringement of the complainant's reissue. They consist of a metallic cross-bar, with slots at the ends for the reception of the straps, and which also connect the ends of the handle.

Several defences are set up in the answer, but the only one necessary to consider is the first, to wit: The want of novelty and prior public use.

I had occasion, heretofore, to inquire into the validity of the complainant's patent, in a controversy between the same complainant, and Speer *et al.*, reported in VI. Off. Gaz. 1874, in which, as in this case, the principal defence turned upon the novelty of the invention. A prior public use was alleged and attempted to be proved. I there said and now repeat "that the patent is *prima facie* evidence that the patentee was the original and first inventor, and that any one who controverts this assumes the burden of proof and undertakes to show affirmatively that there was a prior knowledge and use of the alleged invention under such circumstances, as to give to the public the right of its continued use against the patentee."

The defence in this case has brought out many facts in regard to the public use of the rigid cross-bar in shawl straps anterior to the date of the complainant's patent, which were not developed in the former suit. There is no evidence which in my judgment affects the honesty of the complainant's claim, or which creates any doubt that he really believed himself to be the original and first inventor, but nevertheless I am constrained to the conclusion, after a most careful examination of the whole testimony, that the proofs show with reasonable certainty that he has been anticipated in the invention and that his patent is void, in consequence of the prior knowledge and public use, and the bill must be therefore dismissed with costs.

[*E. B. Barnum*, for complainant.
Arthur v. Briesen, for defendant.]

NEW BOOKS AND PUBLICATIONS.

THE ECONOMIC THEORY OF THE LOCATION OF RAILWAYS. By Arthur M. Wellington, C.E. Price $2.00. New York city: Office of the Railroad Gazette, 73 Broadway.

The author of this book is thoroughly conversant with his subject, and his statement that the book has gradually grown from a few notes into a volume may be accepted as an explanation of the somewhat fragmentary character of the work. He asserts that "all our railways are uneconomically located," and "in many cases these errors are shockingly evident." If these statements are true, he is right in stating that "there is something almost pitiful in the waste of human labor enforced by such costly blundering." He considers that other countries have made lamentable blunders in locating their railroads, so that the suffering stockholders of American lines may take comfort from the thought that others are or may be as badly off.

FRUIT AND BREAD. A Scientific Diet. By Gustav Schlickeysen. Translated from the German by M. L. Holbrook, M.D. With an Appendix. Illustrated. New York city: M. L. Holbrook & Co.

The author and translator of this little treatise are firm believers in vegetarianism, and present in a highly attractive form the main arguments which sustain them in their position. The subject is most carefully and systematically treated, and although the conclusions at which the author arrives are greatly at variance with modern belief and practice, the book is nevertheless entitled to proper and respectful consideration. Illustrations are given of the teeth and stomachs of various animals, and these are compared with the similar organs existing in man, so exhibiting in a clear and satisfactory manner the perfect adaptedness of the latter to a purely vegetable regimen, which is certainly something more than merely accidental. Altogether the book is well worthy of perusal by others than those more immediately interested in the question of diet.

THEORETICAL NAVAL ARCHITECTURE: a Treatise on the Calculations involved in Naval Design. By Samuel J. P. Thearle, F.R.S.N.A., etc. Two Volumes; Text and Plates. New York city: G. P. Putnam's Sons.

This book is designed to meet the requirements of both those who possess but a moderate amount of mathematical knowledge as well as of those who are much further advanced. Numerous formulæ and rules clearly stated will enable the former to perform without much difficulty the ordinary routine of the draughting office, while ample opportunity is afforded the latter to trace back the processes from which these rules have gone forth. The book is divided into six parts. Part I. embraces the calculations relating to the forms and dimensions of ships. II. those relating to the weights and centers of gravity of ships. Part III. refers to the strength of ships. IV. and V. to their propulsion by sails and by steam engines; while Part VI. treats of the calculations relating to steering. An excellent book of plates and tables accompanies the text.

KEMLO'S WATCH REPAIRER'S HANDBOOK: being a complete guide to the young beginner in taking apart, putting together, and thoroughly cleaning the English lever and other foreign watches, and all American watches. By F. Kemlo, Practical Watchmaker. With Illustrations. Price $1.25. Philadelphia, Pa.: Henry Carey Baird & Co.

This work will prove of great value to all in whom the curious mechanism of clocks and watches has excited more than a passing interest. None but skilled followers of the art have been allowed to contribute to its pages, so that the practical worth of the information given can be fully relied upon. A concise history of timekeepers is followed by a clear and exhaustive description of the English lever watch, which in turn is followed by articles on cleaning, putting together, and the conditions necessary to produce a good English watch. American watches deservedly engage considerable attention. Papers on repairing watches, cleaning and repairing clocks, and a short description of the necessary tools complete the book.

RECENT PROGRESS IN SANITARY SCIENCE. By A. R. Leeds. Salem, Mass.: Printed at the Salem Press.

This is a reprint of a paper read at the Lyceum of Natural History, October 9, 1876, by the well known Professor of Chemistry at the Stevens Institute.

WILLIAMS' TOURIST'S MAP AND GUIDE TO COLORADO AND THE SAN JUAN MINES. Price 50 cents each. New York city: H. T. Williams, 46 Beekman street.

Two well edited publications, deserving the attention of travelers and emigrants.

Inventions Patented in England by Americans.

June 7 to June 15, 1877, inclusive.

BOOTS AND SHOES.—Mellen Bray, Newton, Mass.
ELECTRO-MAGNETIC MOTOR.—W. W. Gary, Washington, D. C.
FURNACES.—J. J. Storer, New York city.
GAS.—M. H. Strong, Brooklyn, N. Y.
GAS APPARATUS.—D. C. Smith, East Northwood, N. H.
GAS MACHINES.—T. F. Rowland, Greenpoint, N. Y.
MINERAL WOOL APPARATUS.—A. D. Elbers, Hoboken, N. J.
MOTIVE POWER.—W. G. Smith *et al*, New York city.
POWER LOOMS.—James Long, Philadelphia, Pa.
PULVERIZING MACHINES.—J. J. Storer, New York city.
PUMP.—A. F. Eells *et al.*, Boston, Mass.
REFRIGERATING APPARATUS.—B. J. B. Mills, Lexington, Ky.
SEWING MACHINES.—C. H. Warner, Sturbridge, Mass.
SHEET METAL UTENSILS.—F. G. Niedringhaus, St. Louis, Mo.
VALVE GEAR.—E. Cope *et al.*, Hamilton, Ohio.

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 HAY ELEVATOR.

Eugene L. Church, Walworth, Wis.—This is a hay elevator and carrier of simple and effective construction; and it consists essentially of a traveling carriage locking, by a tilting catch, on a fixed stop block of the track, from which it is released by the action of the bail of the sheave frame of the hay fork on a pivoted grappling hook, the sheave being held in suspended position by the joint action of a fixed hook, of the pivoted hook, and of the tilting catch. A track beam, which is suspended from the rafters of a barn or other building by means of eyebolts passing through the center of the track beam. A carriage runs along the track beam by a pair of flanged wheels, at each end of which the wheels of one pair are set at such distance from each other that they clear readily the suspension bolts as they pass along the same. A hoisting rope is attached, in the customary manner, to a fixed point at one end of carriage, and passed then through the sheave frame of the hay fork, and over a pulley of the carriage, and through a sheave at the end of track beam, and down to the ground, where a horse is hitched to its free end.

IMPROVED CORN HARVESTER.

Bennett Osgood, Lenox, Iowa.—This invention is an improved machine for cutting up the corn, removing the ears from the stalks, and cutting the stalks into pieces, and which may be adjusted to cut up the corn and shock it. As the stalks are carried back by chains, pins or hooks on bars tear open the husks of the ears; and the bars, in connection with rollers, break the ears from the stalks. The ears, when broken off, drop through an opening in the platform into an elevator, up which they are carried, and are discharged into a wagon drawn at the side of the machine. The box of the elevator is supported from the frame of the machine, and its carrier is driven from a shaft by an endless band. The stalks are carried back by endless chains, and allowed to drop from the rear end of the platform upon the brackets attached to the rear bar of the frame. As they fall upon the brackets they are cut into three pieces by two knives, which work in slots in the brackets, and to the upper part of which are pivoted the upper ends of two bars. The lower ends of these bars are pivoted to a crank formed upon the shaft, which revolves in bearings attached to the rear bar of the frame.

IMPROVED SULKY HARROW.

George M. Furman, Laclede, Mo.—This is an improved riding harrow, so constructed that it may be readily raised from the ground, by the driver from his seat, to clear it of rubbish, to pass obstructions, and to pass from place to place, to cut up the ground and cover the seed thoroughly, and be used for cultivating small grain and plants.

IMPROVED HARROW.

Hans Iver Lund, Charlotte, Iowa.—The object of this invention is to furnish an iron harrow which shall be light, strong, and durable, of less draft than an ordinary harrow, of less size, inexpensive in manufacture, and effective in operation, breaking up the lumps thoroughly, and stirring up the soil evenly. The harrow is designed to be made in three sections, all exactly alike, one, two, or three of which may be used at a time.

IMPROVED COMBINED COTTON SCRAPER AND CULTIVATOR.

Malachiah Roby, Kosciusko, Miss.—This machine is so constructed as to bar off and dirt or cultivate cotton plants at one operation; and the invention relates to the construction and arrangement of a center or main beam, to the forward end of which the draft is attached. To the beam, a little in the rear of its forward end, is attached the middle part of a crossbar, in which are formed a number of holes to receive the hooks or clevises by which the forward ends of side beams are secured to said crossbar. To the rear end of the main beam is attached the middle part of a crossbar, to which the rear ends of the side beams are secured by a bow and yoke passed around them diagonally, and which are tightened, when adjusted in place, by nuts screwe updon the ends of the bows. Bands are paseds

around said beams and diagonally around said standards, and tightened in place by wedges or other suitable means, so that the scrapers can be readily adjusted to work deeper or shallower in the ground, and easily detached when not required for use. Cultivating plows or dirters have standards which are attached to the side beams, the plows and standards of the inner side beams being placed in advance of those attached to the outer side beams. When the machine is to be used as a cultivator, the scrapers are detached, and may be replaced by cultivating plows.

IMPROVED CULTIVATOR.

Austin S. McDermott, Prairie Creek (Mellcray P. O.), Iowa.—The object of this invention is to furnish a cultivator which shall be readily adjusted as the character of the work to be done may require, and easily guided and controlled. The tongue of the machine is made in V shape, and its rear end is attached to the axle. The arms of the tongue are connected by a crossbar, to which the doubletree is pivoted by a hammer bolt. To the ends of the axle are attached, or upon them are formed, crank axle arms, upon the journals of which the wheels revolve. To the arms of the tongue, near the forward end of said tongue, are bolted the ends of the forward arms of the three-armed bar, the third arm of which projects to the rearward, and its rear end is bent into U form to receive a curved bar, which is pivoted to the three-armed bar by a bolt that passes through the bend of the three-armed bar and through the center of the curved bar. The ends of the curved bar are secured to the forward ends of the beams by bolts, two to each end. To the rear ends of the beams are attached handles which may be strengthened by braces, and are designed for use in guiding the plows when the machine is used as a walking cultivator.

IMPROVED CHICKEN COOP.

Daniel M. Sullivan and Thomas A. Retallic, Montgomery City, Mo.—This invention consists of a coop adjustable vertically on a standard, and provided with removable partitions and doors for convenience in cleansing. The frame of the coop is placed on a standard, at the top of which is placed a pulley. A cord is attached to the top of the coop frame, and runs over the pulley, and is attached to a counterweight. The coop is divided by a central transverse partition into two compartments, which are subdivided by transverse partitions composed of slats, and held in place by a dowel pin at the bottom and by a pin at the top. The vertical strips that hold the slats of the partitions together are grooved on each side to receive sliding partitions which are arranged on a central longitudinal line of the coop, and at right angles to the partitions. Grooves are also made in the ends and central partition of the coop to receive these sliding partitions.

NEW TEXTILE INVENTIONS.

IMPROVED FULLING MILL.

James Hunter, North Adams, Mass., assignor to himself and James E. Hunter, of same place.—The object of this invention is to improve the construction of fulling mills in such a way that there can be no possibility of injuring the cloth while passing through the rollers, and in such a way as to give the operator full control over the friction caused by the tongue or lever upon the goods, whether said goods be heavy or light.

IMPROVED SHUTTLE-DRIVING MECHANISM FOR NARROW-WARE LOOMS.

William B. Willard, New York city.—This invention, relating to looms for weaving narrow ware, consists in the arrangement of a spur wheel traveling on a fixed rack, and actuating a movable rack attached to the shuttle carrier. Motion is given to the spur wheel by a cam on the main shaft of the machine, which acts through a slotted lever and a connecting rod. The object is to provide mechanism for throwing the shuttle in such looms. In the loom the shuttlerace is divided at its center, leaving a space of sufficient width to admit of the passage and shedding of the warp. The shuttle slides in the race, and is of such length as to overlap the opening, so that it may pass smoothly from one section of the shuttlerace to the other. The shuttle is pierced to receive the fingers of the shuttle carrier, which slides on the bar. The latter is a piece of sheet metal, which is turned over at its upper edge to receive the bar, and is provided with guides for the fingers. The said fingers are capable of engaging with the holes in the shuttle and project below the piece of sheet metal, and are bent at right angles, and provided with grooved friction rollers, which engage with a cam slot of such form that it will draw the fingers, one at a time, downward out of the shuttle, and retain them below the warp during the passage of the portion of the shuttle with which they engage, through the threads of the warp, and replace them after that part of the shuttle passes the warp.

IMPROVED LOOM TEMPLE.

Christian H. Schlaf, Rockville, Conn.—This is an improved device for stretching the cloth while being woven. It is so constructed as to adjust itself as the cloth is being woven and carried forward to the cloth beam.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED THILL COUPLING.

Josiah Kitzmiller, Keedysville, Md.—This is an improvement upon that form of thill coupling in which a pivoted cap is employed to slide over the end of the bolt or pin which secures the eye of the thill iron to the lugs or ears of the axle clip, the said cap serving to prevent the said pin from becoming accidentally displaced without the use of a screw nut or other securing device. It consists in the construction and arrangements of a spring catch for holding said pivoted cap down to its place against any tendency to rise accidentally, the said spring catch being located in a transverse groove or recess in the cap and between the cap and the adjacent lug and being provided with a beveled head and square shoulder, which engages with the under side of the lug to hold the cap down. The merit of this arrangement is that the catch is concealed from sight by the complete inclosure of the spring and the position of the beveled head beneath the coupling, and hence the exterior of the coupling presents a plain, smooth, and neat appearance, free from catches or projections, which would be liable to hook into the clothing in getting into or out of the carriage.

IMPROVED VEHICLE SPRING.

Fredrick W. Faber, Columbus, Texas.—This invention consists in combining an auxiliary spring with a spring suspended from goosenecks attached to the axle, the said auxiliary spring being attached to the axle, and provided with yokes for embracing the suspended spring, the object being to provide a device for steadying the main spring and preventing lateral motion.

IMPROVED TIRE HEATER.

Philip W. Cassil, New Athens, O.—To the top of the furnace or firebox is secured the ring heating chamber, which consists of the ring plate having a ring flange or rim formed around its outer edge. To the ring plate are attached the outer ends of a number of arms, the inner ends of which meet in the center of the ring plate, and have a journal attached to them. The journal may be hollow or solid, and upon it is placed a hub to which are attached a number of radial arms, to the outer ends of which is attached a rim. The rim fits against the inner part of the ring plate, and forms the inner wall of the heating chamber.

IMPROVED CHIMNEY COWL.

Andrew F. Barry and Ira G. Lane, New York city.—This invention is a chimney cowl or ventilator which will deflect the natural current of air, so that a draft is continually maintained. To the upper end of a sheet metal chimney top is attached a strip of metal, bent into a spiral form, and having spaces between the successive convolutions of the spiral. The spirals overlap each other, and increase in diameter toward the top. The coils are connected at intervals by stays, and the end of the upper and outer coil is connected at intervals by stays, and the end of the upper and outer coil is tapped on to the one that precedes it, and is trimmed off horizontally, and tapped on to the one that preceles it, and is trimmed off horizontally, and upon it is placed an ornamental border. The wind, striking this top from any direction, is deflected so as to cause a draft. The device is claimed to be ornamental in appearance, is cheaply and easily made, and does not obstruct the chimney.

IMPROVED WAGON AXLE.

Wilbur F. Buckelew, Shreveport, La.—The object of this invention is to strengthen the wooden axles of wagons, and to fasten the skeins so that they will not become loose. A wooden axle is grooved longitudinally upon its under side throughout its entire length, to receive a rod, which is reduced in size at its ends, and threaded to receive the nuts. This rod is bent so as to conform to the tapering portion of the axle upon which the skein is placed. The skeins, having countersunk outer ends, are placed on the ends of the axle, and nuts having a beveled face corresponding to the countersunk ends of the skeins, are placed on the ends of the rod, and clamp the skeins securely on the axle. By giving the nut this peculiar form, it contains more threads than it otherwise would, and is in consequence stronger. The rod not only serves to retain the skeins securely in their places, but it also acts as a stay or truss rod for the axle, greatly strengthening it.

IMPROVED WAGON BRAKE LEVER.

Jacob P. Outson, Racine, Wis.—This invention consists of a curved ratchet bar and two levers working on the same pivot, one carrying a spring pawl, that engages with the curved ratchet bar, and the other carrying a stud for throwing the pawl out of the notches of the ratchet bar. When the brake is to be applied to the wheels of the wagon, one lever is thrown forward, carrying with it the other lever; and the pawl, by engaging the notches of the bar, holds the lever at any desired point. When it is desired to release the brake first named, the lever is drawn back, moving first the length of the slot, the stud striking the pawl and throwing it out of engagement with the ratchet bar, when the lever may be carried back to any required position.

NEW HOUSEHOLD INVENTIONS.

IMPROVED BAKER.

Luna Drew, Irving, Wis.—This is an improved baking attachment to heating stoves of all kinds, so that the heat of the same may be utilized for baking, warming, raising bread, and other purposes. It consists of a baker supported on adjustable legs, and secured to a round, oval, or square heating stove by suitable top and bottom slides. A warmer is arranged below the baker. The front of the baker is detachable, to admit its use for baking or warming purposes.

IMPROVED FIRE KINDLER.

John G. Distler, Brooklyn (Greenpoint P. O.), N. Y.—This invention is an improved fire kindler, simple in construction, convenient in use, and effective in operation, burning freely, and lasting long enough to fully kindle the fire. It is formed of corncobs, steamed, having a number of transverse holes formed through them, dried, dipped in melted white resin, and wrapped in paper. The corncobs are steamed to prevent them from breaking while being bored. The cobs, while still moist with the steam, have a number of transverse holes bored in them with a rapidly revolving bit, and are then thoroughly dried. When dry the cobs are dipped in melted white resin, and before they are fully cold they are wrapped in ordinary paper, which adheres to them, prevents any odor from passing off into the room, and prevents them from soiling the hands while being handled.

IMPROVED MATCH SAFE.

John A. Field, Racine, Wis.—This is a match safe, the back, top, and front of which are made from a single piece of tin, and to which a lighter of wire cloth is attached, which is placed over a picture, to give the match safe an ornamental appearance. I tis so arranged that the matches are delivered singly to a pair of hooks, from which they may be readily taken by the fingers.

IMPROVED NURSERY CHAIR.

Luther I. Adams, East Templeton, Mass.—This chair may be readily converted into a high or low chair, and in which an attached toy box retains the toys when the chair is in either position. The armed low chair has curved legs. Between the rear legs a shaft is journaled, upon which two wheels are placed. The support for the low parts when it is used as a high chair consists of two similar sides, each composed of two curved strips, which are held together partly by crossbars and partly by triangular metallic pieces that are attached to their upper ends and pivoted to the center of the crossbars that connect the legs. A shaft, having upon it wheels, is journaled in the curved strips at the back of the chair near the lower ends. The toy box consists of a tray that is concaved at its upper edge and is made convex at its lower end, and is provided with a cover that extends over a portion of it, and forms a receptacle for toys when the box is in a vertical position.

IMPROVED FRUIT JAR.

Catherine Hastings, Oswego, N.Y.—This is an improved attachment for fruit jars, to enable them to be conveniently handled when filled with hot fruit, and at other times. It does not interfere with standing the full fruit jars upon their tops, if desired, and enables the jars to be used for holding and carrying various articles. There is a metallic screw band, by which the cover is secured upon the mouth of jar. To the opposite sides of the band are soldered lugs to which are pivoted the ends of a wire bail.

IMPROVED VENTILATOR.

Charles E. Darling, Lewiston, Me., assignor of two thirds his right to Henry Free and John E. Lydston, of same place.—This ventilator for windows, doors, etc., works in noiseless manner, and is watertight. It consists of radially recessed face disks, clamped to the glass frame, and having an intermediate pivoted disk with corresponding recesses that are set by a crank lever and cords into open or closed piston.

IMPROVED BAKING PAN.

Charles I. Kagey and Fred W. Stoneburner, Arcola, Ill.—The body of this roaster is made of sheet iron, and is rectangular in form. To one end of the body a cap is secured, and to the other end a rectangular cast iron frame is fitted, to which a cast iron door is hinged. At the top of the roaster, at or near its center, an aperture is made, which is closed by a tapering projection that extends downward from a plate that is hinged to the top of the roaster. Rings are attached to the top of the roaster near each end for convenience in handling. The apparatus, when in use, is placed upon a stove or in an oven.

IMPROVED STOVEPIPE SHELF.

John W. Jackson, Sharpsville, Pa.—A wire of the requisite strength is bent into the shape required to form the horizontal support. To this the shelf is attached, and also the bracket, which rests against the pipe for supporting the same.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WATER WHEEL.

Isaac Mallery, Dryden, N. Y.—This invention relates to downward discharge turbine water wheels; and it consists in the employment, in combination with a stationary chute case and an independent adjustable frame, of a series of gates, which are pivoted to this frame and adjustable to the periphery of said case. The bucket wheel is formed of curved and inclined buckets arranged around a hub, and applied to a cap ring and a skirting. This wheel is keyed on a driving shaft, stepped on a bridge, and passed up through a tubular sleeve, which is cast on the top of a cylindrical chute or guide case. This case is rigidly secured to the base or bed frame, and constructed with oblique issues, which direct the currents of inflowing water against the buckets of the wheel.

IMPROVED VALVE MOTION FOR STEAM ENGINES.

Henry Haering, New York city.—This is an improved device for operating the slide valve of a steam engine from the piston rod of said engine, in such a way that the valve will be moved slightly to partially uncover the inlet and exhaust ports as the piston completes its stroke, and its motion will be continued in the same direction as the piston begins to move upon the return stroke, until the ports are fully opened, and will then stand still, with the ports fully open, until the piston has nearly completed its return stroke. It consists in the combination of a three-armed bar, two levers, connecting bar, and connecting lever, with the piston rod and the valve stem of a steam engine; and in the combination of a lockbar, spring, two cylinders, and pin, with the two levers and the three-armed bar. As the piston approaches the end of its stroke, the upper end of an upright arm of a bar strikes the concaved side of the upper part of one of the levers operating it, and moving the slide valve to close the ports and admit steam in front of the piston. As the piston begins its return stroke the inclined upper surface of one of the side arms of the three-armed bar comes in contact with the lower end of the said lever, and continues its motion in the same direction, fully opening the said inlet port, which remains fully open until the piston has again nearly completed its stroke.

IMPROVED REVERSIBLE ECCENTRIC.

George G. Lafayette and Pitt W. Strong, Brockville, Ontario, Canada.—This is an improved device to act as a substitute for the link motion on a reversible engine, or for adjusting the stroke of a boiler-feed pump, while in motion, so as to regulate the amount of feed water supplied to the boiler, without the use of an overflow pipe and cock, and keeping thereby the pump constantly in motion, which will save the annoyance frequently experienced in pumps by their refusing to prime after having been stopped for a short time. It may be further used to control the speed of all kinds of engines, whether with plain slide valve or with a cut-off valve working on top of the other by connecting directly to the device a suitable governor, so as to automatically shorten and lengthen the stroke of the valve, and give a uniform motion to the engine under different loads.

IMPROVED EXPANDING REAMER.

Robert Blair, San Francisco, Cal.—In this improved tool there is a clamping bolt by which the cutters are clamped fast after being adjusted. The cutters are arranged to slide directly across the stock in dovetail grooves, and are slotted to slide along the clamping bolt and washers, by which they are clamped fast after they are adjusted to the position required by a toothed pinion and racks. The pinion is arranged in the stock between the cutters, and the shaft extends out of the end of the stock, with a nick in the end for a screwdriver to turn it.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED TORTOISE-SHELL HANDLE.

Christian W. Schaefer, New York city.—The object of this invention is to mount the handles of canes, umbrellas, parasols, whips, opera glasses, and similar articles with a tortoise-shell covering, in such a manner that the present inefficient mode of attaching the same by glue may be dispensed with, the covering attached in tightly fitting and durable manner, and the joint or weld of the edges be not noticeable in the least.

IMPROVED HAND STAMP.

Leonard Tilton, Brooklyn, E. D., N. Y.—This invention consists in novel devices for giving positive rotation to the stamp heads after the impressions are made, in combination with a reciprocating inking pad, and in means for adjusting the throw of the inking pad with respect to the printing faces of the stamp heads.

IMPROVED BUCKLE.

John Fenton, Indianapolis, Ind.—This invention is an improved buckle, neat in appearance, strong and durable, which may be easily fastened and unfastened, which will not require the strap to be perforated, and will hold it securely in any position into which it may be adjusted. The buckle is formed of a plate having holes in its middle part to receive the rivets by which it is secured to the strap, and having cross slots formed in its ends to receive the free end of the said strap, and the eccentric, having its outer side corrugated radially, and provided with a handle.

IMPROVED LIQUID DIFFUSER.

George M. Smyth, Brooklyn, N.Y.—This invention consists in the combination of an air compressor, an air reservoir, and a receptacle for the liquid, and an arrangement of pipes and nozzles for atomizing the liquid. An air compressor of any ordinary construction is connected with the reservoir by a pipe, in which two stopcocks are placed. There is a receptacle for containing the liquid to be diffused or atomized. A pipe passes through a stopper placed in the neck of the said receptacle, and extends nearly to the bottom of the same, and its upper end is provided with a stopcock and nozzle. A nozzle is arranged at right angles to the first-mentioned nozzle, and is attached to a brace that is secured to the pipe

IMPROVED OIL CAN.

John Graves, New York city, assignor to himself and James L. Miller, Westfield, N. J.—This is an improved case for packing oil cans for transportation, the case furnishing the additional facility that the can may be readily inserted into the same and tilted for use. The invention consists of a wooden projecting case with side slots, in which trunnions of the can are guided and supported for swinging the can on pivot hooks, which serve also for the purpose of locking the lid to the case.

IMPROVED HARNESS TUGS.

Charles Hauff, Ashland, O.—The body of the carrier is made in the form of a ring with outwardly projecting flanges around its edges. The strap is passed around the ring in the groove formed by its flanges, and its inner end is sewed to its body at the side. Small wedge-shaped blocks of leather are inserted in the angle between the parts of the strap where they meet and the ring, which angular blocks are covered by angular projection of the flanges of the ring.

IMPROVED COMPOSITION FOR CASTING ORNAMENTAL FIGURES.

August Kiesele, New York city.—This consists in a composition formed by the admixture of dry pulverized sugar, melted paraffin, and stearine. It is poured into moulds and allowed to cool. The article is then removed from the mould, and powdered starch or sugar is dusted over it to destroy the gloss and give it the appearance of alabaster.

IMPROVED PEN RACK.

Harvey W. Forman, Golden City, Col.—This consists of an upper frame with intercrossing wires, forming wide spaces or meshes, and of a second frame with closer wires below the same, for holding the pen in upright position, in connection with a bottom pad or absorbent below the rack frames.

IMPROVED STOPPER FOR MUCILAGE BOTTLE.

James Tilghman, New York city.—This is a combined brush and stopper, consisting essentially of a handle having a stem and a flat end corresponding to the top of the cork. The brush has a flat head, corresponding to the bottom of the cork. The cork is interposed between the said head and end of the handle, and held in place by the central stem.

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.

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Steam Yacht for sale. 31 feet long, 6½ beam; new. John Howard, No. 1730 Rittinhouse st., Philadelphia.

Mothers make selections for themselves uptown, but they always go to Baldwin the Clothier in New York and Brooklyn for boys' outfits.

Wanted—The Agency of small article of merit or novelty for the Hardware or House furnishing lines. W. M. Ernst & Co., 26 Cliff street, New York.

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For Sale.—One 3 ft. Planer, $195; one 8 ft. do., $350; one 26" Lathe, $295; one 22" do., $175; one 15" do., $120. At Shearman's, 132 North 3d street, Philadelphia, Pa.

Inventors.—Send 10 cents for the "Journal of Invention," 4 months. 37 Park Row, N. Y. Room 2.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

Shaw's Noise-Quieting Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R. I.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 40 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Leather and Rubber Belting, Packing, Hose, and Manufacturers' Supplies. Send for list. Greene, Tweed & Co., 18 Park place, N. Y.

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

Blank Book Back-Shaping Machine. Illustrated circular free. Frank Thomas & Co., Home St., Cincinnati, O.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

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For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 30.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

J. P. D. will find directions for colored whitewash on pp. 235, 236, vol. 36.—A. M. will find directions for electroplating on p. 59, vol. 36.—H. P. can recover silver from photographers' waste by the process detailed on p. 250, vol. 27.—A. W. A.'s difficulty as to 64 and 65 squares in the puzzle can be solved by an inspection of the diagrams on p. 323, No. 21, SCIENTIFIC AMERICAN SUPPLEMENT.—I. A. will find a description of a magneto-electric machine on p. 195, vol. 34. A clock thus would go for 12 hours, and wind itself at the same time for 12 hours more, if such a machine could exist, would be a perpetual motion. As to tempering small drills, see p. 186, vol. 26.—R. B. can prevent rust on iron or steel by the means described on p. 26, vol. 25. For a recipe for a depilatory, see p. 186, vol. 34.—A. T. R. is informed that the hydrocarbon engine is reversible. —T. W. will find directions for making sand belts on p. 235, vol. 36.—M. G. should address a manufacturer of oxygen cylinders.—J. S. C., who inquires as to a water fountain, sizes of pipes, etc., should send us a sketch with dimensions.—O. L. is informed that the proper way to ascertain the relative strengths of corrugated and plain sheet metal is by experiment.—G. H. B. will find directions for making colored printing inks on p. 90, vol. 36.—P. M. will find on p. 250, vol. 36, directions for making a polishing starch.—C. H. B. can braze the ends of his brass plate to make a cylinder of it. See p. 219, vol. 36.—W. H. C. is informed that his method of fluting reamers is not new.—C. C. G. will find his method of raising coal or other weights impracticable.—E. S. G. had better test so simple an experiment and satisfy himself.—W. H. C. is informed that the most satisfactory plan would be to get his tools nickel-plated.

(1) J. H. N., of Christ Church, New Zealand, asks: Is the stearin from which the olein has been extracted by Dr. Mott's process fit to be made at once into good stearin candles, without any further treatment? A. Yes.

(2) B. B. says: I wish to express the strongest coloring matter from certain herbs, sage leaves, for instance. How can it best be done cheaply and quickly? Evaporation during several days, after boiling and simmering, has the effect; but it is inconveniently slow. The color produced is a medium brown. A. Dry the leaves, etc., thoroughly, and grind to a fine powder. Digest this for several days in enough warm water to thoroughly moisten it throughout. Then add enough wood naphtha to make a stiff paste, and after standing an hour transfer to a fine linen bag and express the thick liquid in a screw press. 2. Is there anything that will set the color? A. Try a strong hot solution of alum.

(3) H. K. F. M. says: I have a box made of Bohemian crystal. The cover, which was held to the box by a brass frame, has come apart from its frame. It seemed to have been cemented by a hard substance resembling plaster of Paris. How can I make it? A. Boil 3 parts powdered rosin for some time with 1 part of caustic soda and 5 parts of water; then stir into the soap formed one half its weight of plaster of Paris, and use immediately.

(4) F. N. Y. asks: Would a canvas bag, coated with a varnish made of india rubber dissolved in naphtha, be suitable to hold oxygen gas? A. Yes; but bags made of double pieces of cloth, cemented together with the varnish, are better.

(5) J. A. B. asks: Is there any difference between electricity and magnetism? A. Electricity and magnetism are supposed to be manifestations of the same force whose actions are produced at right angles to each other; the action which occurs in the line of polarization being called electricity, and the one at right angles to this line, magnetism. There is an important difference between them, however, as electricity is essentially a dynamic force, while magnetism is purely static.

1. Is not the idea of the world moving around the sun in an elliptic form absurd? A. No. 2. My idea is that the north star is the center of the universe, or in fact is the magnet that all the suns or fixed stars move around, and that the attraction of the pole of the earth, although it moves around the sun, is the cause of the change of seasons, or, in other words, the angle of light. A. There is nothing whatever to support the idea. But a supposed center of the universe has really been designated by some astronomers.

(6) P. S. asks: How much copper wire does it require to construct an electro-magnet that will uphold 100 lbs., and what size of wire should be used? A. Probably 500 or 600 feet of No. 14 copper wire would be sufficient with 3 or 4 very large size Grove cells and cores about 6 inches long and 1 inch in diameter.

(7) H. S. B. says: Water falls about 16 feet per second. My overshot water wheel moves about 4 feet per second. Do I in that way lose that percentage of the actual power of the water? A. Not necessarily.

(8) C. N. B. asks: Can a steam engine be worked with compressed air the same as with steam? A. Generally speaking, it can; but not in every respect.

(9) J. Y. says: If all the measures of length, surface, and capacity in the world, and all the weights were lost, by what means could new ones be made corresponding exactly with those we now have? A. It would be impossible, as all the measures in use refer to certain arbitrary standards.

(10) R. B. G. asks: If a horse be pulling at the end of a lever and traveling 3 miles an hour, how many lbs. pressure against his collar must he exert, to raise 33,000 lbs. 1 foot per minute? A. The force exerted by the animal will depend upon the length of the lever, which should be given.

(11) C. H. McK. asks: Would a pump so constructed as to create an incessant suction draw water an indefinite distance, or how far would it draw it? A. Such a pump would raise water no higher than any other that was equally tight.

(12) J. W. says: I wish to get some boilers made about 12 inches in diameter and 13 inches deep. I want them to stand a pressure corresponding to 400° Fah°. Do you think it would be safe to have them made of cast iron? A. We think it will be better to use wrought iron. Make the shell about ⅛ of an inch thick.

(13) J. R. S. says, in reply to E. W. P., who says that he has an artesian well which does not flow; but from which he pumps by inserting a pipe inside the well tubing, and asks: "If we attach the pump to the well tubing directly, allowing no air to enter the tube, would it not be like trying to pump water from an airtight barrel?" If such were the case, the drive well would be a miserable failure; for in all drive wells the pump is attached directly to the tube. I would advise E. W. P. to attach his pump to the well tube direct, and he will gain three times the amount of water that he now gets. By having his pump attached to the well tube directly, the working of the pump creates a vacuum, and the atmospheric pressure on the earth's surface violently forces the liquid to fill the vacuum thus formed, thereby giving a much greater amount of water than can be otherwise obtained. It is a well established fact that more water can be obtained by the drive well than by any other. A. In our answer to E. W. P., it will be evident, we think, to most of our readers, that we only referred to the case in which the well had no connection with the atmosphere, when the pipe was tightly fitted. It appears, however, that it might have been better to have stated this more definitely, and we gladly embrace the opportunity afforded by the interesting letters of our correspondents. We would be glad to receive from J. R. S. some experimental data in proof of his assertion as to the great gain from a tight connection. This also answers J. T. G. and W. H. F.

(14) H. H. S. says: 1. Given, a boat with a 35 feet keel, of 6 feet beam, with fine lines; also a two-cylinder engine, each cylinder 4 x 5 inches; and a wheel 28 inches in diameter and of 3½ feet pitch. Will an upright boiler, with 135 square feet heating surface, and 4 square feet grate surface, be sufficient to run the engine at 250 or 300 revolutions per minute with 100 lbs. steam? A. With good coal and a forced draft, the boiler may be large enough. 2. What will be the probable speed of boat? A. In smooth water, 7 to 8 miles an hour.

(15) F. A. asks: What would be a safe outside pressure for a cylinder of wrought iron, ½ inch thick and 4 feet in diameter, and 8 feet long? A. According to tables given in Wilson's "Treatise on Steam Boilers," the working pressure for such a tube would be about 65 lbs. per square inch.

(16) F. M. M. asks: 1. How large must an engine be to run a boat 12½ feet wide, 75 feet long, drawing 4 feet of water, at the rate of 30 miles per hour, on a river or bay where the surface is smooth? A. We have some doubts as to whether these conditions could be fulfilled. 2. Do steamboats on the ocean use salt water in their boilers for steam, or do they carry fresh water? A. They ordinarily have surface condensers, so that the water of condensation is returned to the boilers.

(17) E. S. N. says: Please give your ideas as to how much water an engine 18 inches in diameter by 22 inches stroke, running at 145 revolutions per minute, at 80 lbs. steam, cutting off at about 18 inches, will require. We furnished an injector for one of the above dimensions, capable of throwing 900 gallons per hour. It was found to be insufficient, and I went to the mill to discover the cause, if possible. The manufacturers of the injector thought it ought to be large enough, and so did we. I found everything set up properly, and the piston and valve were evidently in good order. I finally measured the capacity of the tank which supplied the injector, and found that it drew 960 gallons per hour. A. We do not think the data are sufficient for an accurate calculation. It is possible, however, that some of our readers have made experiments on similar engines, and can give some useful information.

(18) T. W. asks: What size of breast water wheel, with a fall of 2 feet water, would it require to produce the same power as an overshot wheel of 4 feet diameter, 18 inches face, with a fall of 5 feet water? A. If the breast wheel gave the same efficiency as the other, it would require a face about 2½ times as wide.

(19) A. K. says: A. asserts that if a small and a large boiler be set side by side and connected with the top gauge cock of the two boilers, level, when they are first filled with water, and then steam is raised, that the water will not remain the same, that the pressure will be greater in the larger boiler, and consequently will force the water into the smaller one. B. says that the water will always remain the same as long as the boilers are connected; that the pressure on the water will be the same in both boilers, and therefore the water will always assume the same level in each. Which is right? A. The pressures sometimes vary in two boilers connected in this way; and they should be set in such a way that the water cannot be forced from one into the other under any circumstances.

(20) J. T. G. says: I notice your reply to W. G. in regard to pounding of a steam pump, in which you recommend the use of a larger air vessel. I think that W. G. can remedy the difficulty by allowing a small quantity of air to enter the pump cylinder at each stroke, which can be done without sensibly diminishing the amount of water delivered, provided the lift is not so high as to nearly equal the capacity of the pump. That would keep the maximum quantity of air in the air vessel, and I think that the air in the discharge pipe would have the effect of converting a comparatively rigid column into an elastic one. W. G. can easily try the experiment by running with the drain cocks at the end of his pump partially open; and if that remedies the difficulty, he might insert a small check valve opening inward to prevent the discharge of water during the out-stroke. If W. G. tries this, I wish that he would let us know the result through the SCIENTIFIC AMERICAN.

(21) G. H. says: Please decide the following: A. claims that a team of horses can draw a greater load when hitched close to it than when hitched at a distance of 10 or 20 feet. B. claims that, everything else being equal, distance makes no difference, and that the team could pull as many lbs. at a distance of 20 feet as it could at ten or less. Which is right? A. We incline to B.'s opinion.

Please tell me the relative power of conducting electricity of the principal metals. A. According to Matthiessen, the electrical conductivity of the principal metals, under similar conditions, is as follows:

Silver	100·0	Platinum	18·0
Copper	99·9	Iron	16·8
Gold	80·0	Tin	13·1
Aluminium	56·0	Lead	8·3
Sodium	37·4	German silver	7·7
Zinc	29·0	Antimony	4·6
Cadmium	23·7	Mercury	1·6
Potassium	20·8	Bismuth	1·2

(22) S. R. S. asks: How can lime, or rather phosphate of lime, be precipitated from cod liver oil, which is perfectly clear and said to contain 2 per cent of the phosphate? A. This can only be done by first destroying the organic matter of the oil, and then examining the residue for the phosphates with the usual reagents—magnesia solution, barium chloride, nitrate of silver, ammonium molybdate, etc. With so small a percentage of the phosphates, it will be necessary for you to work with concentrated solutions, and slowly. The oil may be oxidized by treating it on the waterbath with hot hydrochloric acid, with some chlorate of potash, added in small quantities at a time. Then evaporate down nearly to dryness, and treat with a little strong nitric and a few drops of sulphuric acid. This will take some time if properly done.

(23) J. H. S. says, in answer to J. H. B.'s query as to a parrot pulling out his feathers: Take a knife and scrape the inside edge of the bill, and the feathers will slip from the bill without coming out. This is done for feather-eating hens; no doubt it will answer for a parrot as well.

(24) S. R. S. says: I have some dentists' pellet gold. I alloyed it with brass and silver. I melted it several times, but it was so very brittle that I could not work it. I then added a $2½ gold coin, and fused, all together, but it was as brittle as before. I then fused it and dropped in lumps of pure saltpeter, but it is still as brittle as before. I fused the gold on a lump of charcoal with an alcohol blowpipe. Please tell me how to work it. A. You fail to state the proportions of your alloy. There may be an excess of zinc and copper, or the fusion may not have been complete. Place it, together with several small pieces of rosin and a little borax or carbonate of soda, in a small blacklead crucible, and heat to very bright redness over a good fire. If this does not obviate the difficulty, fuse the alloy with about three times its weight of nitrate of potassa (saltpeter), and treat the mass when cold with dilute sulphuric acid. Pour off the acid solution and fuse the alloy, together with any silver sulphate adhering to it and a little carbonate of soda. Any silver contained in the acid solution may be recovered by adding a little salt or muriatic acid, and fusing the precipitated chloride of silver with carbonate of soda.

(25) N. S. asks: 1. Can water be decomposed into its constituents (oxygen and hydrogen) with any considerable rapidity, and in large quantities, by electricity? A. Yes; providing a large magneto-electric machine be used. 2. What is the best and cheapest method of generating hydrogen in large quantities? A. The action of iron or zinc scraps on diluted oil of vitriol is among the best. A considerable volume of pure hydrogen may also be obtained with facility by passing superheated steam through a large iron tube filled with scrap iron heated to bright redness.

(26) G. S. D. W. asks: Is there any process by which an engraving can be transferred either to stone or wood, where the printing ink can be made to show up as black as in the original after the transfer has been made? A. We know of no satisfactory method whereby this may be accomplished directly. By means of the chromate of gelatin photographic process, such transfers may be made without great difficulty.

(27) F. M. M. asks: 1. If a steamboat 100 feet long, of 5 feet beam and 4 feet draught, be provided with one set of common side paddle wheels, and power enough to run it at the rate of 10 knots per hour, would two sets of side wheels, with the power doubled and the revolutions of the wheels doubled, double the speed of the boat? A. No. 2. If we take the same boat, side wheels, and power, for running 10 knots per hour, and arrange for the side wheels to feather their paddles, what effect would it have on the speed of the boat? A. You might obtain from 10 to 15 per cent more of the power of the engine in useful effect.

(28) W. J. T. asks: 1. What is the best dark color to paint a laboratory, and what kind of paint must I use? A. One of the best for this purpose is shellac in alcohol, colored to suit with Vandyke or Spanish brown, etc. 2. I wish to varnish my benches. What varnish would you recommend? A. Shellac is commonly used, but copal gives good results, also Brunswick black in oil.

Of what should a waste water pipe be made, so as to resist acids? A. Make it of lead or block tin.

Can you recommend an elementary work on electric batteries? A. Sprague's "Electricity: its Theory, Sources, and Applications," is one of the best.

(29) T. P. H. asks: Can I take a wax impression off type and then electrotype it with a battery? A. Yes. This is the common method of making electrotypes for printing from.

(30) C. M. asks: What are the locations of the various branch mints of the United States? A. A recent authority gives them as Philadelphia, Pa., San Francisco, Cal., Carson City, Nev., and Denver, Col. Assay offices are situated at New York city, Charlotte, N. C., and Boise City, Idaho.

(31) B. L. D. asks: Can you give me a recipe for making paste for sharpening razors, knives, etc.? A. Mix the finest emery obtainable with a little suet.

(32) C. B. McM. says: I hear that four gallon measures of different capacities are in use, and that the United States standard gallon contains 230 cubic inches. In the confusion of text-book statements such as —"wine gallon=231 cubic inches," "beer gallon = 282 cubic inches," "American standard gallon = 58973 grains (Youmans' Chemistry) = nearly 234 cubic inches," and the very extensive ignorance of what is really correct, please repeat the information in a way that may be quoted as authority for the capacity of a United States gallon in cubic inches, and the weight in grains. A. "The gallon of the United States is the standard or Winchester wine gallon of 231 cubic inches, and contains 8·3388822 lbs. avoirdupois, or 58372·1754 troy grains of distilled water at 39·83° Fah., the barometer being at 30 inches. It is equal to 3·785307 liters. The gallon of the State of New York is of the capacity of 8 lbs. pure water at its maximum density, or 221·184 cubic inches. It is equal to 3·62346 liters."—*Appleton's Cyclopædia.*

(33) S. C. D. says: Please give directions for electrotyping cylindrical rollers for impressing upon sheets of wax, accurately, of the proper figure for honeycomb foundations. The figure for the surface of the cylinders to be derived from sheets of wax foundation, having the figure correctly impressed upon them. A. This can be done by coating with plumbago, and then electrotyping with copper, in a way familiar to most printers and to all electrotyping establishments. The plates can afterwards be bent round a roller, and used to impress the sheets of wax.

(34) J. H. T. asks: There is a piece of ground, 100 rods long and 10 rods wide at one end, running to a point at the other, which we wish to divide into 4 equal lots. Please give a rule. A. Let the 100 rods be the base of a triangle, divide it into 4 parts of 25 rods each, and join the apex with each of the three dividing points. You will then have 4 triangles on equal bases and between the same parallels, which, according to Euclid, are equal to each other.

(35) R. S. asks: What are the chemical qualities of bisulphide of lime, and how can I prepare it? A. The bisulphide of calcium (CaS_2) is produced by boiling milk of lime with sulphur and water, but not long enough to allow the lime to become completely saturated. The filtered liquid, on cooling, deposits crystals whose composition agrees with the formula $CaS_2 + 3H_2O$. Exposed to the air, it soon absorbs oxygen, becoming converted into insoluble sulphate of calcium. Its aqueous solutions are likewise decomposed. Its reactions with the metallic salts are similar to those of the alkaline sulphides.

(36) H. M. S. asks: 1. Of what is the bronze preparation made and how is it applied to clock fronts? A. Bronze powders are made of various metallic alloys. The gold bronze is usually made of Dutch gold (an alloy of copper and zinc) and of the bisulphide of tin (*aurum musivum*). They are usually applied to metal work by means of an oil size or japan varnish. 2. In what way can I remove the old bronze? A. Wash first with a solution of washing soda (hot), clean and dry, and then rub with a little benzole, alcohol, or ether.

(37) W. E. W. asks: 1. Of what mixture is the bright red paint usually put upon axes made? A. It consists of fine vermilion ground with 1 part boiled oil and 2 parts turpentine. 2. Is more than one coat applied? A. One coat will suffice. It is best applied with a fine brush, when the metal is warm.

(38) C. M. B. asks: Is the odor emitted by the ailanthus tree unwholesome? A. It is considered so by many, but we have no proof as to the facts.

(39) L. S. & Co. ask: Is there anything known which would clean the hands from paints and lacquers without the use of turpentine? A. A little ammonia and benzine or naphtha, aided by a little sand, is often used in stubborn cases; put plenty of good soap and warm water, with a stiff brush or a small piece of pumicestone, will ordinarily suffice.

(40) W. P. S., Jr., says: Can you give me a recipe for making *papier maché*? A. *Papier maché* is obtained from old paper and the like made into a pulp by grinding with milk of lime or lime water, and a little gum dextrin or starch. This pulp is then pressed into form, coated with linseed oil, baked at a high temperature, and finally varnished. The pulp is sometimes mixed with clay (kaolin), chalk, etc.; and other kinds are made of a paste of pulp and recently slaked lime. This is used for ornamenting wood, etc.

(41) M. P. B. says, in reply to a correspondent who asked how to prevent his water filter from getting choked up: Fit in the filter, on the top of the charcoal, a piece of board having in the center a circular hole from two to four inches in diameter, according to the size of the filter; force in this a sponge so tightly that all the water has to pass through it first, but not so as to prevent its free passage. This sponge will absorb readily the gross impurities of the water, and can easily be taken out and cleaned once or twice a week.

(42) A. C. S. asks: 1. Is there any reason why lightning rod points should always be bright, if the points are kept sufficiently sharp? A. It makes no difference if the points are not bright. 2. If lightning rods put up in the ordinary way above the roof terminate in the eaves' spouting of the house, and said spouting had good ground connections, would this not be equal to the best lightning rod, and thereby save many feet of rod and many dollars of expense? A. The arrangement you suggest would be good. Make a thoroughly good ground connection with leaders, have all joints well soldered, and you may dispense with the rod as you propose.

(43) J. A. W. says: Having occasion to do some copper plating some time ago, I dissolved sulphate of copper in water in a glass jar. I then poured it off into my battery, and there was some left in the jar. I threw a small piece of iron into it and left it for some days. I then took it out; and to my surprise, I found that it had been perfectly plated with copper. Please let me know the cause? A. The reaction you note is taken advantage of to cheaply copper plate small articles of cast iron. See answer to J. O. M., p. 347, vol. 36. In the presence of water, the reaction is as follows:

$$CuSO_4 + Fe = FeSO_4 + Cu.$$

Sulphate of copper. Iron. Sulphate of iron. Copper. As the iron is a more positive metal than copper, it displaced the latter in combination with acids, the remaining portions of the iron becoming coated with the precipitated copper.

(44) A. G. asks: Is the silver, for a reflecting telescope, put on the back of the glass the same as on looking glasses? A. No. Only one side of the glass is ground and polished to the shape required. The silvering is done on this side; and then, with the softest buckskin and the finest rouge, the surface of the silver is polished for the reflecting surface. In cities where gas is used, it will not retain its brilliancy very long; then it requires to be cleaned with nitric acid and resilvered, which is only the work of a few hours when a person has become accustomed to it.

(45) A. L. B. says: 1. I understand that, in modern chemistry, the acids and alkalies are the two extremes of a class of substances called hydrates, the only difference being the radical. In the reaction of nitric acid, HO NO_5 or HNO_3 on potassic hydrate, KOH is KO NO_5, or KNO_3, and H_2O. Which molecule loses the oxygen atom, and why should one part with it more than the other?

A. HNO_3 (Nitric acid) + KOH (potassic hydrate) = KNO_3 (potassic nitrate) + H_2O (water)

In this reaction the potassium is considered, by virtue of its greater affinity, as replacing the hydrogen atom in the hydric nitrate; the hydrogen in turn satisfying the OH group to form water. These hydrates are similar only in point of constitution. Their chemical deportments are widely different. 2. What are oxides in modern chemistry? A. The bodies formed by the direct combination of oxygen with the elementary bodies are called oxides. With water some of these oxides form hydrates, as K_2O (potassium oxide) + H_2O (water) = 2(KHO) (potassic hydrate)

(46) J. R. M. asks: To have a circular saw run well, should the mandrel have a little end play if it is desired to relieve the saw and guides of strain? A. If the saw is not true or the carriage runs crooked, end play of the mandrel to the extent of the deviations will relieve the strain upon the saw. But if the carriage runs true and the saw true, the mandrel should have no end play.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

M. S. M.—It is a quartz crystal, the opposite sides of which have been ground flat, probably by artificial means.—F. B.—It is graphite.

COMMUNICATIONS RECEIVED.

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

On a Battery and Electric Clock. By J. E. W.
On Anti-Water Drinking. By C. P. W.
On Snakes Catching Fish. By C. R. G.
On Utilization of Sewage. By Dr. H. D. T.
On Aerial Navigation. By C. W.
On the Ash-Colored Salamander. By C. F. S.

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 makes machinery suitable for making flour barrels? Whose is the best theodolite? Who sells steam whistles? Whose is the cheapest silk suitable for balloons? Who makes the best engraving machine for transferring designs to copper?" 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.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 5, 1877,

AND EACH BEARING THAT DATE.

[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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DESIGNS PATENTED.

10,030 to 10,032.—EMBROIDERY.—E. Crisand, New Haven, Conn.
10,033.—LOCK-CASE.—R. Flocke, Newark, N. J.
10,034.—BOTTLES.—J. H. Harrison, Davenport, Iowa.
10,035 to 10,037.—CARPET.—H. S. Kerr, Philadelphia, Pa.
10,038, 10,039.—CARPETS.—T. J. Stearns, Boston, Mass.
10,040.—MOULDING.—R. M. Merrill *et al.*, Laconia, N. H.
10,041 to 10,044.—OIL CLOTH.—C. T. Meyer *et al.*, Bergen, N. J.
10,045.—STUDS, ETC.—J. W. Miller *et al.*, Newark, N. J.
10,046.—BOOK CASES.—J. W. Schuckers, New York city.

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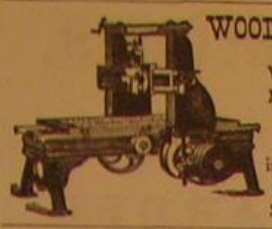
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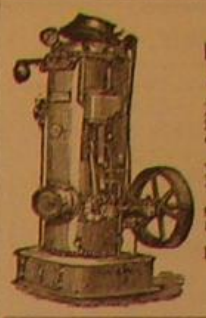
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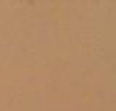
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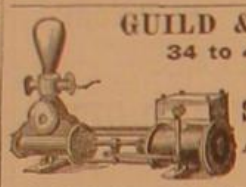
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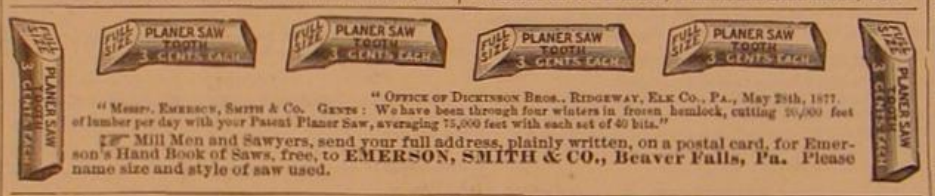
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THE MANUFACTURE OF SHEET LEAD AND LEAD PIPE.

The principal manufactures of lead are sheet lead, lead pipe, and shot. The first two constitute the subject of the present article: the third we shall consider separately in a future issue. Lead enters into commerce in the form of pigs, varying in shape, weight, and fineness, as it comes from different sources. Spanish lead is imported in pigs weighing from 150 to 170 lbs. each, and is the pure metal, having been thoroughly refined before export. American lead, and especially that from the Mississippi valley, is commonly sent East for extraction of the silver, the baser metal being afterwards sold for about enough to pay the cost of the refinement. As a rule, manufacturers purchase their stock from bankers and other financial agents, to whom the metal is consigned in return for advancements, and who thus constitute a class of middlemen between producer and the class above mentioned.

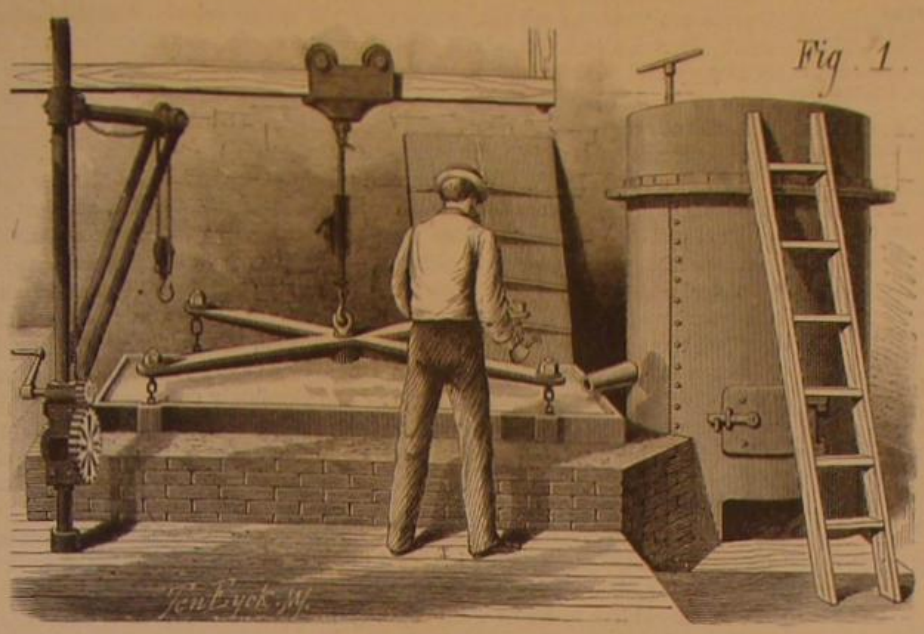
As lead is made into sheets by rolling, the first process to which it is subjected is melting and casting into cakes of suitable size. The melting kettle and mould are represented in Fig. 1. About ten tons are melted at a time, and the liquid metal is, on raising a valve in the kettle, allowed to escape directly into the iron mould, which receives four and a half tons. Lifting hooks are previously adjusted in place under the cake so that the latter, when solidified, can be lifted out of the mould and carried by a crane upon the table of the rolling mill. The size of the cake is seven feet ten inches by five feet. After remaining in the mould some days to cool, it is lifted out, and the rough edges are trimmed off with an adze. It is then placed upon the rolling mill table in the direction of its least width; that is, so that the breadth of seven feet ten inches shall be invariable, while the five feet length is increased by the rolling.

The mill, Fig. 2, is a single cylinder of cast iron thirty inches in diameter and nearly nine feet long. It is geared directly to the main driving engine, and has the adjustments common to all rolls. The table is an assemblage of small rollers arranged in two parallel lines. Between them is a rack, the teeth of which serve as fulcra for the insertion of levers whereby the cake is pushed under the cylinder. The rolling once begun, the metal passes to and fro under the roll about a hundred and fifty times, so that it is finally reduced to a sheet thirty feet long and of the width above stated. It then weighs 30 lbs. to the square foot. This sheet is cut into smaller pieces by vertical knives, which are actuated by a screw, so that they move across the table and between the cylinders on which the metal rests. The smaller sheets are now rolled into eighteen foot lengths, and vary in weight from 2½ to 10 lbs. per square foot. These constitute the usual sheet lead stock—the variation being half a pound to the foot up to five pounds, and one pound per foot thereafter. Their principal utilization is in chemical works for lining acid-proof receptacles, notably sulphuric acid chambers and concentrating pans, and also for the interior of tanks, cisterns, etc. The thinnest sheet lead is that employed by the Chinese for covering the interior of tea chests. This, however, is produced in China by simple casting and pressure. The operation is performed by two men, one of whom pours the molten lead from a crucible upon a large flat slab, when the other quickly places a large stone on the fluid lead and presses it out to a thin flat plate, which is then removed and trimmed. Sheet lead is also used in the manufacture of the so-called tin foil. A sheet of lead is placed between two layers of tin, and the whole is rolled and re-rolled until the thin material with which all are familiar is produced. The tin serves in this case simply as a covering for the lead, and prevents the latter metal communicating its deleterious properties to the substance inclosed.

Lead pipe is made by forcing the partially congealed molten lead through dies in which a core is inserted by hydraulic pressure. The apparatus for this purpose is exhibited in the large illustration (Fig. 3); and in Fig. 4 a section of the essential portion of the same is shown. The die, A is simply a metal disk in which is an aperture which fixes the outside diameter of the pipe to be made. This opening flares downward. The die is inserted in a collar which, in turn, rests in the bed piece, and is adjustable so as to bring the die accurately in line by means of the set screws, B. Resting above die and bed piece is the lead

[Continued on page 34.]

Fig. 1.



MELTING THE LEAD.

Fig. 3.

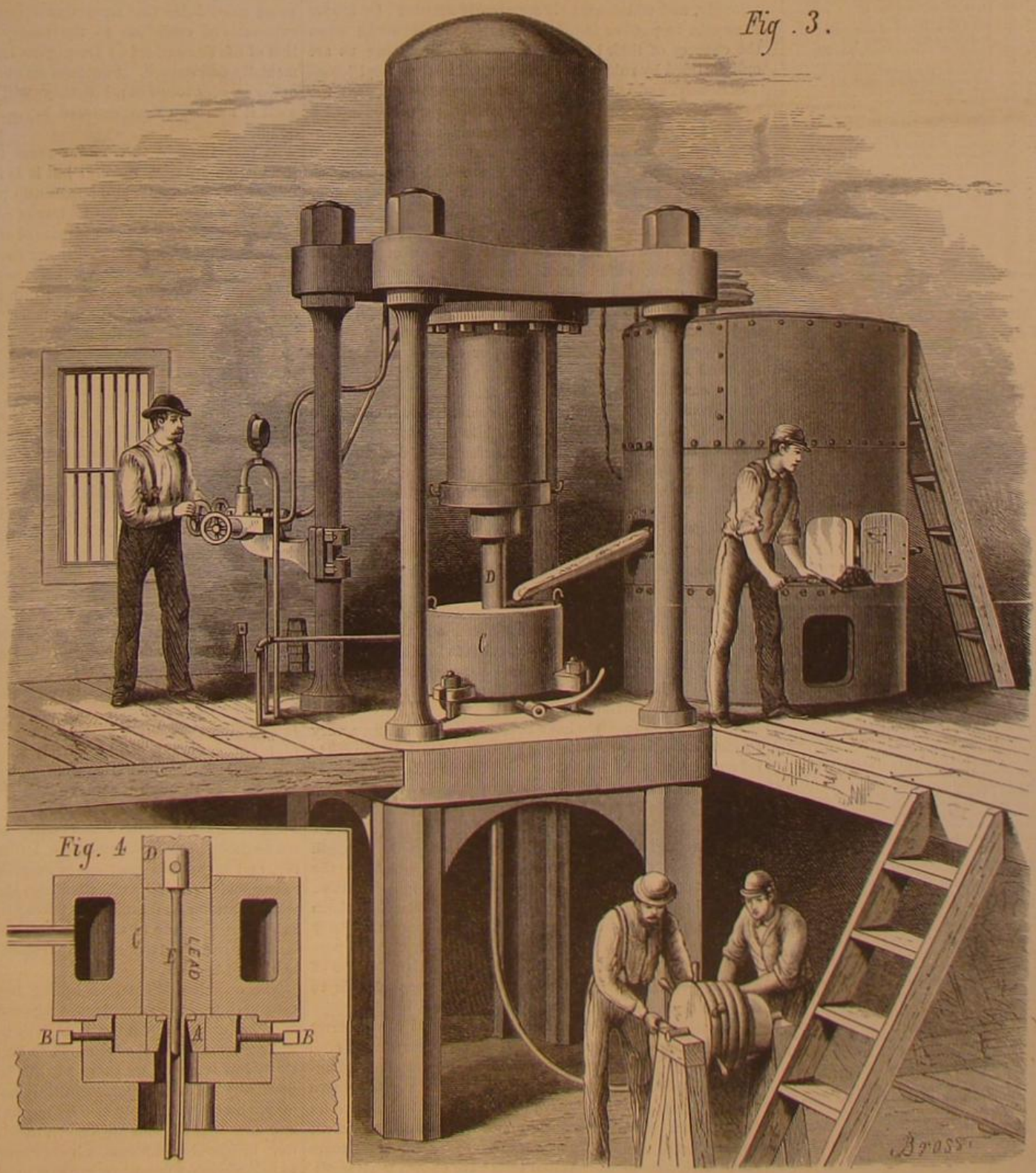


Fig. 4

THE MANUFACTURE OF SHEET LEAD AND LEAD PIPE.

Scientific American.

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AN INEXACT SCIENCE.

It seems to us that civil engineering—or at least the civil engineering practice of the past—has, if we are to credit the *dicta* of modern eminent theorists, fairly earned the above title. Here, for instance, are two important works before us, respectively dealing with two great branches of the profession, hydraulic engineering and engineering constructions. The first is entitled "The New Formula for Mean Velocity of Discharge of Rivers and Canals," by W. R. Kutter, translated by Mr. Louis D'A. Jackson, a well known authority. In the preface we are told that the whole of the old velocity formulæ of Eytelwein, Stevenson, Dubriat, Prony, and others, which have been used as "the bases of calculations of discharge for tables, which are still unfortunately believed in by the unreflecting," have no claim to general application, that, in short, said formulæ are altogether erroneous; and in some cases, tabulated velocities based thereon are "but the wildest guesses at the actual velocities." Herr Kutter's formula, founded on the experiments of D'Arcy and Bazin, Humphreys and Abbot, and others, is now absolutely correct; and the other formulæ, with the aid of which our engineering forefathers apparently managed to complete some substantial work, are proscribed.

Now also comes Dr. Weyrauch; and in the preface to his admirable work on "Strength and Calculations of Dimensions of Iron and Steel Constructions," we are told that "the methods hitherto employed in calculating the dimensions of iron steel constructions have been entirely wrong; and that the security of structures, in which their results have been applied, though with great expenditure of material, is much less than supposed." And thereupon Dr. Weyrauch gives us an excellent book, demonstrating new and absolutely correct formulæ, and also proceeds to proscribe the other formulæ which have been relied upon in the building of a great many structures in years past, structures which, unaccountable as it may appear, still manifest no inclination to fall down. Dr. Weyrauch's and Herr Kutter's formulæ are, we are given to understand, fully indorsed by the engineering profession, and, we have no doubt, with excellent reason; but we should like to know what is going to be done about all the engineering work which, in the absence of any other, must have been based on these now scouted and repudiated rules. Are we to leave standing bridges and buildings, the dimensions of every member of which has been calculated wrongly, and which are only apparently secure? Or are we to remain in passive indifference to our waterworks when the chances of their breaking down and drowning us are only fortified by rules based on the "wildest guesses?"

Seriously, and while we shall not presume to say that the two eminent engineers above quoted have proceeded a whit too far in their condemnation of the old rules, we may at least question the fact whether engineers in actual practice confine themselves so closely to theoretical deductions as these and most textbook writers would have us suppose. Indeed, we think it will be found that the average civil engineer—and we may as well include the mechanical engineer with his professional relative—will prefer his own judgment and the teachings of his own experience in matters of construction, especially if both qualities have been often successfully tested, to almost any one's theoretical *dicta*. Not that we mean to say that our engineers constantly prefer thumb rules to scientific accuracy, or dash at conclusions by guesswork. On the contrary, we think, in point of the care displayed in and the exactness of their construction, American civil engineering structures will compare favorably with any in the world, while our mechanical appliances are already renowned for perfection of design. But we believe that, in most instances, if the constructors or designers were asked whose or which formulæ they followed, the large majority would assert that their experience had been taken as the principal guide upon which to found their own theory. A noted civil engineer—one who has constructed perhaps more railway bridges than any other man in the country—recently said that he had never used the calculus in his work in his life. Yet almost any textbook on strains and stresses teems with formulæ based on that abstruse branch of mathematics. The calculus is invaluable to the mathematician; but here at least is one engineer who takes the responsibility of figuring his strains and selecting his sizes of material without its aid.

Another instance: We have before us a letter from a very eminent experimenter upon the strength of metals, etc. He informs us that, by his recent investigations, involving an immense number of experiments, the report of which before many months will be made public, the deductions of Rankine and other authorities as to strength of chain are wholly wrong: that the stud does not increase the strength of links, and the strongest links are not made from the strongest bars, besides other somewhat startling deductions. Theoretically at least, then, all our chain cables have been made under erroneous rules; practically, however, they have served their purpose. It cannot be conceived that new theories in chain construction, or in any other branch of science involving constructive work, can cause materials to do more than is expressed in the latter phrase.

The columns of this journal show perhaps most clearly how much our improved forms of machinery are due to constructive skill based on practice. Take any mechanical invention, adapted by its originator after long study to achieve a certain purpose, and observe its form as first published on these pages. Search for that device five years afterwards, and it is hardly recognizable. Experience has called for more metal here, less there. Actual tests have shown what modifications of the machine are necessary to render it most efficient in its duty; and these modifications have suggested others, and so on. It can be safely stated that, in hundreds of our best mechanical appliances, their capabilities were not known until they were tested. Furthermore, the rule, in nine cases out of ten here (we know it is not so abroad), is that a mechanic wanting a new special machine for a special purpose will design the apparatus which his experience tells him is best adapted to his ends, and test it to determine its duty, search for failings, improve it, and so work up to the desired point; and this he will do while his brother of the Old World is puzzling over his drawing board to discover how, by Greek letter formulæ and the differential calculus, he can produce a device that will give the wished-for results on the first trial. We have a profound respect for theory, for it should be the essence of a vast amount of practice. But if we had a bridge to build, we would prefer the man who had already built half a dozen successfully to the theorist and mathematician who had constructed none except on paper in his study, and those according to formulæ which may be repudiated a year hence.

THE GREAT PROBLEM.

That the earth was at one time incapable of sustaining life, and that at some time in the course of events life began to be, no one doubts for a moment. It is also pretty generally admitted among scientific men that the beginning of life was in all probability a natural event; and that the earlier forms of life did not embrace the more complex types now existing, but were of simpler structure, perhaps not unlike the lowly organisms now studied under the microscope.

Here the question arises: Was the beginning of life a phenomenon single and unique, and are the bacteria of today the unaltered descendants of the earliest forms of life? Or may life have began, and may it still begin, at any time by the concurrence of suitable conditions? This is by all odds the most important question now before the scientific world; and curiously the most strenuous opponents of the theory that life may begin now as well as ever, are found among those who, like Professor Tyndall, believe life to have been derived originally from purely material combinations. That matter should have lost any of its intrinsic "power and potency" in the course of ages seems altogether unlikely; so we must infer that the active opposition of the leading exponents of evolution to the theory of the recent evolution of life *de novo*, arises from pure loyalty to truth experimentally determined. Spontaneous generation is the logical outcome of evolution; but they will not admit the fact until it has been demonstrated beyond the possibility of a doubt.

At first thought this might seem to be a question of speculative interest merely: but it is far more than that. Some of these minute and apparently primary forms of life are among the most potent factors of human health and disease, and of the health and disease of the animals and plants most intimately connected with our sustenance and general wellbeing. Even the air we breathe seems at times to be contaminated by their presence; our blood is poisoned by them, and the struggle for existence rises or degenerates into a struggle against them. It is no wonder then that the question of their origin is one of the highest practical as well as popular interest, or that the foremost men in biological science have essayed its solution.

Years of critical investigation have stripped the problem of many confusing and irrelevant conditions until it stands nakedly thus: Can we take matter which contained no life, perfectly isolate it from possible impregnation, and subject it to conditions under which it will bring forth objects that live and multiply? If so, what kind of matter must be used, and what are the conditions favorable to such origination of life?

Thanks to the labors of many of the acutest minds in experimental science—among them Pasteur and Pouchet, in France; Huitzinga, Cohn, Klebs, Bilbroth, in Holland, Austria and Prussia; Mantegozza, Cantoni and Ochl, in Italy; Bastian, Lister, Sanderson, Tyndall, Dallinger and Roberts, in England; Wyman and others in our own country, with any number of less eminent investigators—the primary conditions of the problem have been satisfactorily mastered. It is admitted by all that by subjecting matter to a sufficiently high temperature it can be entirely freed from life and life germs. It is admitted that the all-pervading germs of life cannot pass through a sound plate of glass; consequently any substance to be tested can be kept perfectly isolated by hermetically sealing the vessel containing it. Other successful methods have been employed; but this is the most exacting, and is beyond question or suspicion when used with reasonable care. It is admitted also that the temperature at which putrefaction ordinarily takes place most actively is a proper temperature at which to keep the fluids under examination; and fluids must be used since they are the natural habitat of bacteria.

The question, What is a killing temperature? has been very hard to settle; that is, a temperature high enough to surely destroy life, yet not so high as to endanger the chemical composition of the solutions to be tested. A comparatively low temperature suffices to kill bacteria, and so far as positively known, bacteria multiply only by fission. They may, however, multiply also by means of invisible germs; and since many germs are known to withstand a higher heat than the developed forms, a higher temperature than suffices to kill bacteria must be insisted on in all experiments in this

field. Precisely how much higher, the opponents of spontaneous generation leave an open question, and increase the demand with every failure of a supposed killing heat to prevent the development of life. A series of experiments made by Bastian some years ago, and never in any way invalidated by conflicting experiments, would seem, however, to have placed this question beyond further dispute, though his opponents are very apt to quietly ignore them. His method was briefly this: to take a test-fluid which never engendered life except when purposely inoculated with multiplying bacteria, and never failed to produce life when so inoculated; then after mixing the test-fluid with a bacteria-bearing liquid, heat the mixture after perfect isolation, and await the result. If life appeared, the heating was assumed to be insufficient to kill all the life introduced; if no life appeared, after repeated trials, the temperature was considered fatal. The heat which produced sterility in different fluids varied between 130° and 158° Fah., and the latter was found to be the maximum temperature which a growing and multiplying swarm of bacteria,—in all stages of growth and presumably including the hypothetical germs, if such there be,—could survive. When, therefore, this experimenter found other fluids (capable of spontaneous putrefaction in the open air) to swarm with bacteria after having been subjected to a temperature of 212° Fah. for hours, and thoroughly isolated from any possible contact with germ-bearing air, he claimed to be justified in the conclusion that there had been in such fluids a real origination of life not derived from antecedent life.

A great variety of animal and vegetable infusions, and some purely inorganic solutions have been used in such experiments, with varying results. While it has been found to be impossible to predict the behavior of any particular fluid from its composition, it appears from many observations that neutral or faintly alkaline fluids are more likely to putrify, after boiling and sealing, than acid infusions. Excess of alkali, however, prevents the development of life as well as an excess of acid; and some infusions are found to be almost always sterile unless exactly neutralized; yet positive results have been obtained in many instances, Bastian claims, with both acid and alkaline fluids. The fluids which he found to be most commonly successful were infusions of turnip and hay; the former fortified with a little cheese dust being almost certain to develop life.

It was with infusions of this character that the sceptical Dr. Burden-Sanderson tested Dr. Bastian's conclusions by a series of experimental tests made under his opponent's personal supervision; and failing to detect any flaw in the process, he frankly and publicly admitted that he had been mistaken in his previons doubts. The same experiments were thereupon repeated, and their results verified by Professor Huitzinga, of the University of Groningen, who afterwards made a series of fresh trials, using a mixture of grape sugar and soluble salts instead of the turnip infusion, and substituting soluble peptone for the cheese dust. In every instance, he declares, bacteria appeared when the ingredients were used in certain specified proportions. By altering the proportions of the ingredients he was able to keep his solutions sterile, although in other respects they were treated exactly as before; and he relied on this differential process to prove that any pre-existing germs in the liquid were destroyed and perfect isolation obtained, for the altered fluids were found capable of developing bacteria if once inoculated. Thus having two fluids, each capable of supporting bacteria, both were subjected to the same process of boiling and sealing. After repeated trials, in which one solution invariably swarmed with bacteria and the other as invariably remained clear, it was inferred that all germs had been destroyed by the heat and subsequently kept out by perfect sealing; and that the life developed in the one was due wholly to its proper chemical composition.

The only reply that the opponents of spontaneous generation can make to tests like these is that, in all cases where life appears, there has been either an insufficient exclusion of germs, or else that, owing to the composition of the solution, the contained germs were somehow protected and enabled to withstand a temperature which was fatal to those in the other solutions. Thus there always remains a possibility of doubt, and the result is disputed. A pretty illustration of the almost hopeless struggle which the spontaneous generationists have to wage with persistent doubt is seen in the last controversy between Bastian and Pasteur.

For a number of years Pasteur has held, in spite of Bastian's experiments in regard to the death-point of bacteria, that bacteria germs are not killed in acid fluids below the boiling-point of water, while in neutral or faintly alkaline fluids they are able to survive a somewhat higher temperature. In any case, however, he admits that a temperature of 110° C. is fatal; consequently no life can appear in fluids so heated and kept perfectly isolated. A short time ago, Bastian devised the following test of the alleged protective influence of alkalinity. He placed in a retort a measured quantity of urine of ascertained acidity; also in a small tube a quantity of liquor potassæ, somewhat less than enough to neutralize the urine—his experiments proving that a larger quantity was likely to overdo the matter. He then sealed the potash tube in a blow pipe flame, drawing out the sealed end so that it would break easily, and boiled the inclosed liquor potassæ to kill any possible germs it might contain. Then he placed the tube in the retort with the urine, which was boiled and hermetically sealed in the usual way.

The question to be decided was this: Acid urine does not putrefy (that is, develop bacteria) after boiling; alkaline urine sometimes does—the difference being attributed by Pasteur and his school to the protective action of the alkali. Now, if acid urine after boiling (by which process its inclosed germs are admitted to be destroyed) be neutralized by a liquor also made sterile by prolonged boiling, it ought not to develop life; if it does, the result cannot be due to any protective action of the alkali, which is not added until after the germs are killed.

After cooling, retorts as above described were shaken so as to break off the fragile end of the inclosed potash tube and allow the contained fluid to mix with and neutralize the boiled urine; then they were placed in an incubating bath kept at a temperature about 122° Fah., together with other retorts similarly treated, except that the potash tubes were not broken. After a day or two, the neutralized urine invariably putrefied, while the acid urine in the control flasks remained permanently barren. Having thus shown that the effect was the same, whether the acidity of the urine was reduced after or before boiling, Bastian insisted that the influence of the potash was not due to its alleged power of protecting the germs so as to enable them to bear a higher temperature, but to some vivifying chemical or molecular action, and claimed a victory for spontaneous generation.

Pasteur repeated the experiment with a like result, but was not satisfied; so he tried again, substituting solid potash for the liquor potassæ, and the result was negative; to which Bastian replied that the potash had been used in excess. Pasteur retorted with a charge of insufficient heating of the potash in Bastian's experiments, and challenged him to repeat the experiment with the single variation that the potash tube should be heated either for twenty minutes at 110° C., or for five minutes at 130° C.

Bastian did so, and more: he kept the potash tubes at the required temperature for twenty *hours*, and obtained life as before. To this Pasteur's only reply was a vehement protest that the alleged result was impossible.

The English opponents of spontaneous generation have more wisely endeavored to prove the impossibility of such a result by critical experimentation. Among these, Dr. Roberts, of Manchester, and Professor Tyndall, both claim to have repeated the experiments over and over again, and always without obtaining life. This is not the first time that Dr. Bastian's assertions have been flatly contradicted; and he knows from experience what it is to have his opponents afterwards admit, in the face of experimental evidence, that he was right and they were wrong. The issue has been so narrowed now that it ought not to be impossible for the opposing parties to agree to undertake together a series of crucial experiments. By mutual suggestion, skill, and watchfulness, the common charge of inexactness in manipulation, or prejudice in the interpretation of results, ought easily to be prevented, and the issue fairly and squarely met. Isolated partisan work, however skillful, will not force a conclusion nearly so quickly or satisfactorily as united effort; and to that test we hope, for the credit of science, the question will be speedily submitted.

THE PHYSICAL CHARACTERISTICS OF AMERICAN CHILDREN.

Some months ago we renewed the data relative to the height and weight of Americans, drawn from the records of the Provost Marshal General's Bureau, made during the late war. The conclusions reached were that, in point of stature, even the lowest mean obtained would entitle the American people to the first rank among nations. The results of measurements of nearly a million and a half of American born white men exhibited a mean stature of 67·646 inches. In the matter of weight it further appeared that Brother Jonathan is as heavy as the heaviest even in his youth: and the apparent slimness of his immaturity, due to his superior height, is fairly made up by the time he reaches his full development.

The above important series of investigations on the physical characteristics of Americans, has recently been supplemented by researches made by Dr. H. P. Bowditch, of Boston, Mass., in which the object of inquiry has been the growth of children. Both sexes are included, so that a direct comparison is instituted between them. About 24,500 observations were made upon the pupils of the schools in Boston and vicinity. These were tabulated according to nationality, etc., and from these tables graphic diagrams were constructed, exhibiting with great clearness the results obtained. Both tables and diagrams, together with Dr. Bowditch's report, are before us, in the recently issued Eighth Annual Report of the State Board of Health of Massachusetts. From the data obtained relative to the comparative rate of growth of the sexes, it appears that the greatest annual increase in height occurs for girls at 12 and for boys at 16 years of age, while the maximum increase in weight is, for boys at the same age, and for girls one year later than the maximum increase in height. In other words, at about the ages of 13 and 14 years girls are (during more than two years) both taller and heavier than boys at the same age, though before and after that period the reverse is the case. Dr. Bowditch points out, that on the principle enunciated by Carpenter and Herbert Spencer, that growth and reproduction are to some extent antagonistic properties, it may reasonably be supposed that at the age at which the organism becomes potentially reproductive, a period of excessive growth will not occur; and the data above noted seem to show that this is the case.

From the tables exhibiting effect of race on size and rate of growth, it appears that, almost without exception, American children are both taller and heavier than children of the same age and sex whose parents are of other nationalities. One of the most curious facts brought out by Dr. Baxter in the investigations referred to in our initial paragraph, was that natives of foreign countries enlisting in the United States, possessed a greater average height than natives of the same countries enlisting at home. Dr. Baxter explained this circumstance by a difference in the average age of the individuals mentioned, but Dr. Gould, through other statistical investigations, has shown that, even making allowance for this difference of age, the same result holds true. Now, Dr. Bowditch presents the opinion that the superiority of stature is owing to the greater average comfort of the people of this country, as compared to that of inhabitants of European States, and the observations of Quetelet, Villerme, and Cowell, which are referred to, seem further to show that in a given community the children of the wealthier classes are, as a rule, larger than those of the poorer classes.

But it is evident that an important question is, whether similar conclusions to those reached by Drs. Baxter and Gould for adults are applicable to growing children, and in order to eliminate the possible effect which comfort or misery may have on the rate of growth, it is necessary to select for comparison, sets of observations made upon children belonging to corresponding classes in the communities in which they live. To this end, the pupils of certain select schools in Boston were compared with those belonging to non-laboring classes attending English public schools and universities; and the two sets of figures show the marked superiority of the American boy, both in size and weight. Hence the superior size of American children may be taken as due partly to the greater comfort surrounding them, and partly to difference of race and stock.

One of the most interesting portions of the entire investigation is that which deals with the relation of height to weight in growing children of both sexes and of various races. Growing boys are heavier in proportion to their height than growing girls, until the height of 58 inches is reached. Above that point the reverse is the case. The difference between children of American and those of foreign parents is constant in one direction for all ages. Boys of German parentage, who are uniformly heavier in proportion to their height than American boys, form the exception to the rule. The deprivation of the comforts of life, curiously enough, exercises a greater tendency to diminish the stature than the weight of the growing child. And finally Dr. Baxter's conclusion "that the mean weight of the white native of the United States is not disproportionate to his stature," is, as far as boys are concerned, as applicable to growing children as to adults.

Dr. Bowditch appends to his report reference to the formulæ determined by Professor Lanza; and based on the observations of President Runkle, of the Massachusetts Institute of Technology, expressing the relation between the weight and height of growing children from five to eighteen years of age. In the case of boys ranging in height from 42 to 66 inches inclusive, the formula is $y=0{\cdot}002428\ x^{3{\cdot}49}$; and in that of girls ranging in height from 42 to 61 inches inclusive, the expression is $y=0{\cdot}001277\ x^{3{\cdot}73}$, y representing the weight in pounds, and x the height in inches, in both cases. These formulæ are quite accurate, as the greatest difference between calculated and observed values is, in the case of boys, 0·65 lbs., and in that of girls, 1·41 lbs., with one exception, where it is 3·01 lbs.

Dr. Bowditch's investigations are replete with suggestions for future statistical research, the results of which can scarcely fail to be of the highest value to the community. To those who may undertake the necessary inquiries, the following subjects are commended. Drs. Gould and Baxter having shown that the size of adult Americans is very different in different States of the Union, and even in different parts of the same State, it would be interesting to determine, by observations of children, how early in life this difference becomes apparent; in general, what is the influence of geographical and climatic conditions of growing children? What number of generations is necessary for the complete development of the influence of changed climatic conditions on the rate of growth of a given race? This examination might be conducted on emigrants and their descendants, coming from some limited region of the old world. What effect (if any) does the season of the year have on rate of growth? And what is the comparative effect of city and of country life on the same? What is the relation between diseases and the rate of growth? Dr. Bowditch suggests that it would be especially interesting "to inquire whether in the rapid growth, which is said to follow certain diseases, especially fevers, the height and weight increase in normal ratio: whether this accelerated growth *after* the disease is simply a compensation for a retardation *during* the disease; whether abnormally rapid growth causes a predisposition to disease, and whether any connection can be traced between the rate of growth and the frequency with which certain diseases of growing children (*e. g.*, *chorea*) occur at different ages." Finally, by systematic comparative study of the physique of the growing population in different localities, the effect of local hygienic conditions might be determined.

In our SUPPLEMENT of this week particulars and engravings are given of a remarkably powerful and fast little steam launch designed by H. S. Maxim. Boiler 26 inches length, 20 inches diameter. Test pressure, 450 lbs. per inch. Length of boat, 21 feet. Speed, 10 miles per hour.

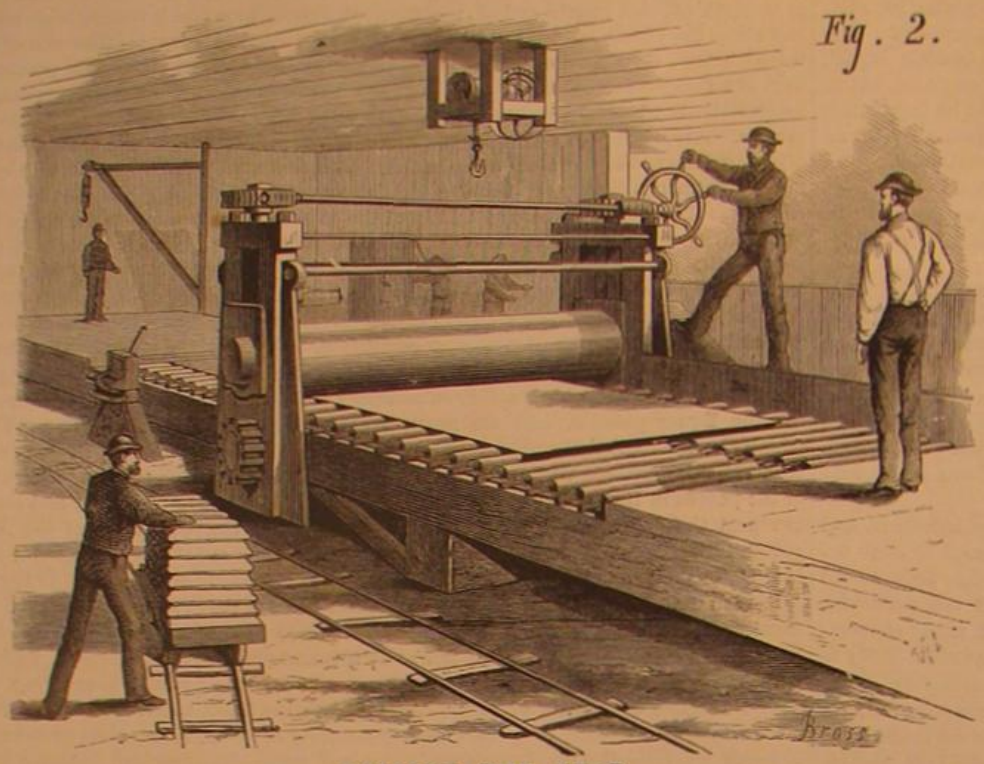
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receptacle, C. This is a heavy cylinder having an annular chamber formed in it to receive the steam by which it is kept hot. D is the press plunger working downward, and in it is inserted the core, E, which enters the die aperture. The metal is drawn off directly from the kettle, and the plunger is at once brought down upon it, so that it may be kept under moderate pressure until sufficiently congealed. The press is then set in operation, and the lead is forced through the annular space between the core and die, and emerges in the form of pipe. The process is quite rapid, and there is nothing further to do but reel up the pipe as it is drawn. As soon as one charge is exhausted or rather partially so, as a portion is left in the chamber to which the new charge unites, more lead is admitted from the furnace, and the operation is repeated. The amount of pipe made at a single pressure depends upon the weight of the same when finished. Thus an extra light one-inch pipe weighs 2 lbs. to the foot, and the chamber may, for example, hold 135 lbs. Therefore 67½ feet of pipe are produced at each descent of the plunger. Different sizes of pipes are produced by substituting suitable dies and cores. The die is easily reached by lifting the chamber, C, which is done by attaching the same to the press plunger and elevating the latter.

Tin-lined lead pipe is produced somewhat differently. Before the lead is run into the chamber, a mandrel is inserted, which closes the die aperture and extends up through the receptacle. This mandrel consists of a central stem, around which are grouped dovetailed sections, so that when the central portion is removed the sections are easily taken out, leaving a hollow space in the lead which is run in while the mandrel is in place. The sides of the mandrel are tapered, or rather crenelated, there being three or four shoulders and a different taper from each. The object of this is that after the mandrel is removed, the tin which is poured into its place may have several purchases against the lead which surrounds it. Of course before the tin is let in, the core, as already described, is inserted. Afterwards the pressure is applied in the usual manner, the result being that the pipe emerges with a thin lining of tin. Tin-lined lead pipe and plain lead pipe weigh the same.

There are some trade peculiarities about the sale of lead pipe which are worth remembering. That which is termed tubing measures from ¼ and ½ inch in diameter, and weighs 2 and 5 ounces to the foot. Ordinary lead pipe varies ¼ inch in diameter from ¾ to ¾ inch, inclusive; then ¼ inch from 1 to 1½ inches, and lastly there is a 2 inch size. Beginning at 1½ inch, and ranging at ½ inch increase to 5 and then to 6 inches, comes lead waste pipe. Of ordinary pipe there are, besides, several classes depending on weight and ranging from extra strong to "fountain" size. The Colwell Lead Company, of this city, has courteously offered us the facilities or the preparation of the foregoing description and illustrations.

Fig. 2.



ROLLING THE LEAD.

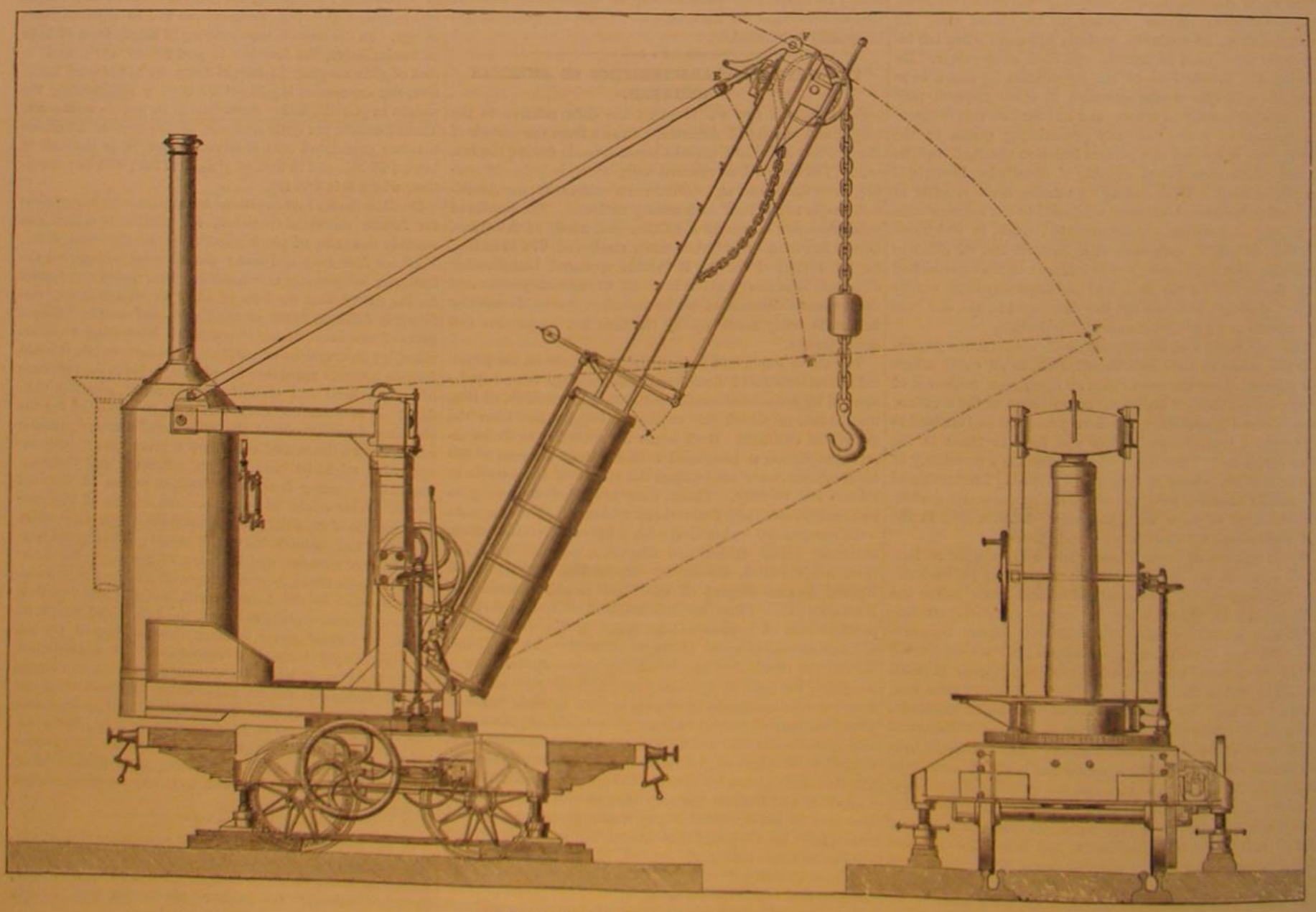
THE following compound is recommended by the *Revue Industrielle* as an artificial fuel well suited for cooking purposes: To 176 lbs. of small charcoal made from light wood add 44 lbs. of pulverized charcoal, 11 lbs. of nitric acid, 4·4 lbs. of nitrate of potash, and 11 lbs. of gum arabic. The gum serves as agglomerating material. A rather expensive fuel this!

LARGE LOCOMOTIVE CRANE.

We illustrate herewith a new 10-ton locomotive crane, the invention of M. J. Chretien, and designed for use on the Northern Railway of France. The principal feature of novelty in the machine is that the load is lifted by the direct pull of the piston in a long steam cylinder, the piston rod being attached to the lifting chain or to pulleys of the same. A D slide valve admits steam and is changed automatically in time to prevent the piston meeting the end of the cylinder by a simple stop mechanism.

The machine consists of a strong cast iron frame mounted on wheels, and having at its center a column which serves as a pivot for the traverse which supports the turning portion of the crane. The boiler is placed in rear and serves as a counterpoise. The derrick arm consists, first, of a cylinder 15·6 inches in diameter, and 111 inches long, and a double T arm which supports the chain pulley. The apparatus may be used not only for handling heavy loads, but as a locomotive for hauling cars. Means are provided for lowering both smoke stack and derrick so that bridges may be passed under.

The locomotive engine is placed under the platform, as shown. It has a single cylinder connected with the boiler by a pipe passing through the crane pivot. Simple gearing serves for the transmission of power to the driving wheels. For rendering the apparatus stationary four jack screws, placed at the corners of the carriage, are employed. These press the traverse to which they are connected firmly against the ground, and thus render the machine immovable. For raising or lowering the arm, the mechanism for elevating the load is easily employed. When the arm is in normal position, as indicated in the engraving, the guys are retained above by two catches. Two small chains attached to the guys are pendant or fixed to retaining hooks. To lower the arm, the lower ends of these chains are taken to the piston, and there secured to hooks provided for the purpose. Steam is then admitted above the piston. As soon as the chains are tautened the arm rises slightly, and the disengaged catches lift. Then the steam is allowed to escape slowly, and the arm is thus permitted gradually to descend until stopped by the piston reaching the end of the cylinder. During this operation the point, F, travels to F', E to E'.



NEW 10-TON LOCOMOTIVE CRANE.

and the guys are elongated by the intermediation of the chains over the distance, E' F'. The arm is lifted by the reverse operation. Steam is admitted into the cylinder, and the crane is swung upward until caught as before by the catches. We extract our engraving from the *Revue Industrielle.*

Wrought Iron Girder Work.

Mr. Graham Smith, in a paper read before the Liverpool Engineering Society upon wrought iron girder work, stated that one of the first and principal requirements in designing wrought iron girder work, was to have a proper sense of the limits of application of theoretical deductions. He then showed that, in order to be able to design an iron girder, something more than proficiency in mechanical calculations was necessary, many circumstances having to be taken into account which experience has shown materially affect the structure, when exposed to variations of strain and temperature. In the designing of their bridges, American engineers compared very favorably with their English brothers. The life of an iron girder depended upon the strains to which it was subjected being kept well within the elasticity of the iron; and when engines and rolling stock were increased in weight beyond what was originally estimated, and this limit was passed, we ought not to be surprised if a bridge did give way now and then. Another point upon which the durability of an iron structure depended, was the state of efficiency in which the paintwork was maintained. He gave some valuable remarks upon preparing ironwork for painting, laying special stress upon care being taken with work for abroad, in situations where it would subsequently receive but little attention. Mr. Smith thought engineers did not sufficiently consider the sizes of iron to be employed in executing their designs. It was well known to manufacturers that iron above certain sizes and weight commanded extra prices, and it was shown that carelessness in this matter would sometimes double the cost of a structure. It was considered very desirable to test all the iron to be used in constructing girders; and he showed how this was to be done in an efficient manner. Various small matters connected with the riveting and construction generally, were brought forward in an amusing manner, fully demonstrating the necessity of having a working inspector always on the ground. Mr. Smith then went at some length into the preparing of drawings and specifications, and concluded by referring to Barff's process of coating iron with magnetic oxide.

THE GREAT ERUPTION AT HAWAII.

M. Ballieu, Consul of France at Honolulu, has sent to his government a detailed account of the great volcanic eruption which occurred at Hawaii on February 14 last. The phenomenon took place on Mauna Loa, at about nine o'clock in the evening. Nine great jets of flame and smoke burst from the crater of Mokuaweoweo, and united in an immense column which rose to a height of 16,000 feet. The nine fires appeared to form two groups—one of four, the other of five columns, the latter being the more brilliant. The scene is depicted in the engravings herewith given, which we extract from *La Nature.* Fig. 1 also conveys an excellent idea of the location of the volcano. N and S respectively indicate the north and south points, + is the crater of Mokuaweoweo, ++ is Mauna Loa, +++ the central plateau, ++++ is the town of Kaw; A represents Kawaihe, and B Hualailai. Viewed from Hilo the jets all seemed joined in one vast spout of fire, as represented in Fig. 2.

The eruption, a full description of which we published some time ago, lasted but six hours, and was followed nine days afterwards by earthquakes and a submarine eruption near Heei Point.



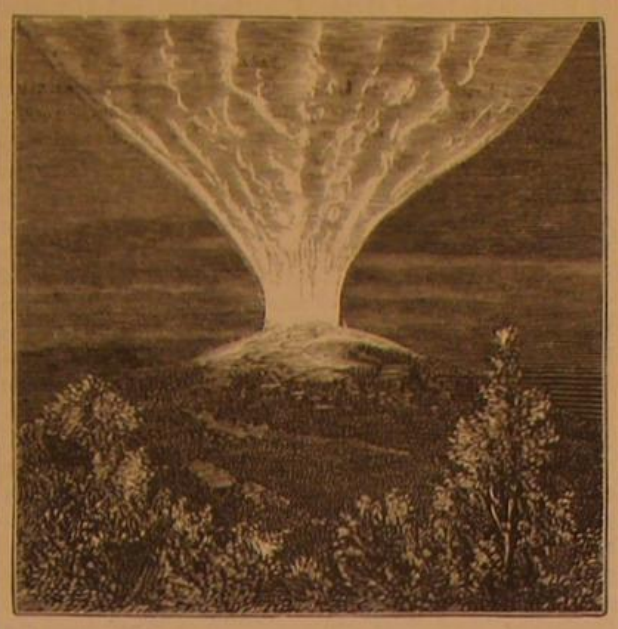
GREAT VOLCANIC ERUPTION AT HAWAII.—Fig. 1.

Singular Balloon Accident.

A fearful accident lately occurred at Hull, Eng., by which a large number of persons were seriously injured.

It appears that for several years a gala has been held every Whit Monday, in a large field in the Beverley Road, and this year one of the attractions advertised was the ascent of a balloon. Arrangements were made with the British Gas Company for a supply of gas, it being estimated the balloon would require for its inflation about 18,000 cubic feet. There being a strong wind at the time it was filled, the balloon, although securely fixed to the ground with ropes, swayed vigorously from side to side. We learn from the local papers that close to the ring in which the filling took place there was a "striking machine," against which, just as the ascent was about to take place, the balloon was driven, and a long slit was made in the silk, through which the gas began to escape rapidly. Close to the striking machine which had caused so much damage there was a stall for the sale of hot peas, a kind of refreshment greatly in demand at entertainments of this kind. Very shortly before the balloon drove upon this stall a naphtha lamp had been suspended thereon, and the escaping stream of gas coming in contact with this naked light, a fearful explosion followed.

Spectators of the scene state that what they saw was a vivid flash, as of lightning, followed by a dense white smoke,



VOLCANIC ERUPTION AT HAWAII.—Fig. 2.

this in turn being followed by a blaze which lasted so long as there was any of the varnished silk of which the balloon was composed remaining to be consumed. From the midst of this mass of smoke and flame there arose a mighty cry of anguish, and the excitement amongst the spectators was most intense. The policemen on duty at the gala, with many others who were not too much excited to act, at once rushed to the rescue, and soon one and another were hauled out from amongst the burning mass. When the balloon collapsed, owing to the escape and ignition of the gas, it fell upon quite a crowd of persons, who were completely covered by the silk and the netting in which it was inclosed, and these people, mostly young men and women and children, were rendered powerless to help themselves. Their position was, besides, rendered the more awful by the fact that the varnish with which the silk composing the balloon was covered, when it became heated, caused the burning material to stick to the hands and faces of the sufferers, and in numberless instances the skin was torn away from hands and faces as the unconsumed material was removed. Amongst the injured was a little girl, who was so frightfully burned that she expired the next day.

Five Centuries Buried.

The *Ariégeois* relates as follows the finding of the body of a bishop at Saint Lizier, France: "The discovery was made in the wall of the cathedral cloister. The skin is yellow, but not mummified. The arms were crossed over the breast, and the head slightly inclined to the left. The hands were still gloved, sandals were on the feet, and having been carefully removed, the members were found to be in a perfect state of preservation. No article of value was found in the tomb. A leathern cord around the neck must have carried the pastoral cross, which was sought for in vain. The body is proved to be that of Mgr. Auger II., of Montefalcone, Bishop of Couserans, who died in 1303."

New Method of Detecting Potash.

Ad. Carnot publishes a new and delicate test for potash. Dissolve one part (10 grains) of subnitrate of bismuth in a few drops of hydrochloric acid; then dissolve separately two parts (20 grains) crystallized hyposulphite of soda in a small quantity of water; pour the second solution into the first and add an excess of strong alcohol. If a portion of this reagent be brought into contact with a few drops of a soluble potash salt, a yellow precipitate is immediately formed; if the potash salt is not in solution a light yellow, but very distinct coloration is produced. All potash salts of the mineral acids give this reaction. Barium and strontium are the only metals that might be mistaken for potash, as they form white double salts with this reagent. As these bases seldom occur along with potash, it is easy to recognize and remove them. If a solution contains but a few grains of potash, it should be evaporated to a small volume or to dryness in order to obtain the reaction more distinctly. Another way is to saturate a strip of filter paper with this solution and dry it. The yellow color will be seen on the edges of the paper.

Owing to the remarkable solubility of all the simple and most of the double salts of potash, its detection has been quite difficult. The usual reagents hitherto in use were a solution of tartaric acid, which must be freshly prepared, and chloride of platinum, which is expensive and not very satisfactory, owing to the difficulty of perceiving a slight yellow precipitate in a deep yellow liquid.

The Preservation of Flowers.

A new method of preserving flowers, successfully adopted by Dr. Miergues, is reported in the *Gardener's Magazine.* Each flower, held by the extremity of the stalk, is plunged into a vessel of paraffin, quickly withdrawn, and twirled rapidly between the finger and thumb, so as to shake off the superfluous oil. Bouquets of flowers thus treated have been kept upwards of a twelvemonth without losing their shape or colors. Whether the smell of paraffin be equally persistent, the doctor has forgotten to inform us.

An Electrical Plant.

In a recent number of the *Hamburger Garten- und Blumenzeitung,* Levy describes a plant, which, if the statements of this traveler are true, must be a most remarkable wonder. It is one of the *phytolacca* which seems to be new, and has received the name of *phytolacca electrica.* The curious fact about this plant is its strongly marked electro-magnetic properties. On breaking off a twig a sensation is produced in the hand like that given by a Ruhmkorff induction coil. This sensation was so marked that he began to experiment with a small compass. The compass began to be affected by it at a distance of seven or eight paces. The needle vibrated on approaching nearer to it, and finally began to revolve rapidly. On receding, the phenomena were repeated in reversed order. In the soil where this plant grew, there was not a trace of iron or other magnetic metal, like nickel or cobalt, and there is no doubt that the plant itself possesses these peculiar properties. The strength of the phenomena varied with the time of day. During the night it is almost nothing, and reaches its maximum about two o'clock in the afternoon. When the weather is stormy the energy increases still more, and when it rains the plant appears withered. Levy also states that he never saw any insects or birds on or about this electrical plant.

Nathan R. Smith.

Professor Nathan R. Smith, the distinguished surgeon and medical practitioner, died in Baltimore in the eighty-first year of his age. For many years he had been the acknowledged head of the profession in that city, and up to within a few years past has been in full practice. The deceased was a native of Cornish, N.H. In 1825 he was appointed professor of surgery and anatomy in the University of Vermont, and organized the medical school of that institution. In 1827 he accepted the chair of surgery in the medical department of the University of Maryland, which he filled for many years. He was well known as a writer in various medical journals, and published a voluminous work on the surgical anatomy of the arteries, which was well received in this country and Europe.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Mr. Hunt, the gentleman whose patent was withheld as mentioned in my previous letter, feeling himself aggrieved by the Commissioners in that matter, has issued a circular hinting at collusion between the Commissioner and his ex-partners, and denouncing the former for his action in the case. This has been followed by an order from the Commissioner, approved by the Secretary of the Interior, suspending Mr. Hunt from practice before the office.

After a contest of about two years between Faber, of Munich; Jacobson, of Berlin; Schwanhausen, of Bavaria; Batchelder, of Boston; the American Pencil Company, and the Eagle Pencil Company, of New York, as to the priority of the invention of what is known as the copying pencil, by the use of which a transfer copy can be taken by moistening the paper, the controversy has been concluded by a decision of the Commissioner in favor of the Eagle Pencil Company, as assignees of Charles Walpouski, who is adjudged to be the original inventor.

Gen. W. G. Le Duc, of Minnesota, has been appointed Commissioner of Agriculture. The papers here speak very highly of his knowledge of the science and practice of agriculture, and assert that he has always been prominently connected with the agricultural interests of his State.

The June reports of the Agricultural Department indicate a better prospect than usual for wheat. The report of June, 1876, made the average for the country thirteen percentum below the standard of normal condition, and the subsequent returns of condition and yield were still lower, forecasting the scarcity which has occurred. The average for winter and spring wheat together is one hundred this year, winter wheat being above that figure and spring wheat below it. There are 227 counties reporting winter wheat in full normal condition; 494 counties above one hundred, and 183 below it. Spring wheat in 92 counties is reported at one hundred, 117 counties above that figure, and 137 below. The reports from California indicate only half a full crop, from a deficiency of winter rain fall. Fewer injuries than usual from insects and rust are reported. In the Ohio valley nearly every return is favorable, but in Pennsylvania and Tennessee a slight depreciation is caused by the Hessian fly. The only serious injury is that caused by the grasshopper, which has been most destructive in Minnesota, hatching numerously through all the settled portions of the State. In the west of Iowa and throughout the wheat fields of Kansas and Nebraska the losses from the hopper are reduced to a minimum by the effects of wet and cold weather after hatching and subsequently by the successful warfare of the farmers. In some portions of Texas the destruction of wheat by grasshoppers has been quite heavy.

Reports to the Department from the South indicate that the total average of cotton planted this year is nearly four percentum in excess of that of last year. The season is stated to have been too wet at the time of planting, and too dry since in all of the cotton growing districts except Texas. The growth now, however, although small, is generally healthy, clean, and in a good condition for rapid improvement with favorable weather.

The prospects of the peach crop this year are exceedingly good. The Delaware growers are watching their trees with great interest, feeling certain that, without some extraordinary misfortune, the yield will exceed anything heretofore known, and feeling puzzled what to do to realize the most money from what promises to be a glut. Notwithstanding the great efforts made last season to find new outlets for the surplus, there remained a vast quantity of fruit which could not be utilized. Peaches rotted by the millions, and the hucksters in some of the cities had hard work to dispose of their stock at any price when the season was at its height. The experiment of sending fresh peaches to England was a failure, but fruit preserved by evaporation can be and has been sent in great quantities. For the year ending June 1876, dried fruits to the value of $600,000 were exported, while during the same period of time ending on the first of the present month this amount was increased to $2,500,000. By the new apparatus now in use for drying fruit, called "evaporators," the fruit is left in such a natural condition that England is calling for it in vast quantities; and France is also using large quantities of dried fruits, especially apples, which are made into wine and reshipped in that form to the American market. The Delaware peach growers are now preparing to dry their fruit by the "evaporators," and expect to find a ready and profitable market for it. Peaches dried in this way bring from twenty-five to thirty-five cents per pound, and each basket of peaches will turn out three and a half pounds of evaporated fruit—hence higher prices can be obtained from England than by glutting the market in this country. The only drawback to the use of these evaporators is their great cost, and there appears to be a demand for apparatus that will accomplish the same results at a less price.

Professor Baird, of the United States Fish Commission, is about to leave here for the purpose of collecting information and statistics in regard to the food fishes of the New England coast, between Salem and Portland, and will have his headquarters at the former place. Particular attention will be given this season to the collection of information in regard to the cod, mackerel, blue fish, tuntog, menhaden, scar herring, haddock, pollock cusk, and hake. During the past season the Commission have hatched out about 9,000,000 young shad in the Susquehanna, at Havre de Grace, over 1,000,000 of which have been distributed in Western and Southern waters, and about 1,000,000 are now *en route* to the waters of California. Active preparations are now being made to distribute a large number of salmon eggs and young salmon next fall throughout the country. Over 5,000,000 eggs and young were distributed last fall, but a much larger number will be sent off this season. The principal salmon hatching establishment is at MacLoud river, California, the species of salmon found there being most suitable for Eastern rivers, like the Susquehanna, Delaware, Potomac, and Cape Fear. Professor Baird has recently given considerable attention to importing carp from Germany, as the finest fish of this kind is found there. Four hundred and fifty large carp were recently imported by the steamer Neckar. They are now in the ponds of the Maryland Fish Commission for breeding purposes, and their young will be distributed throughout the South. Other importations will be made soon.

Major Powell, who has charge of the geological and geographical survey of the territories, has already sent out five surveying parties, all of which are at work in Utah. A triangulation party, under Professor Thompson, is located on the eastern slope of the Wasatch mountains; three geographical parties, under Messrs. Renshaw, Wheeler, and Graves, are at work on the Uintah, Price and Lower Green rivers; and a geographical party, under Captain Dutton, is located on the Sevier Plateaus. The major is about to leave for the field himself, but before starting will fit out two other parties, one of which will make a specialty of the subject of irrigation in Utah.

Preparations for an improvement in the devices on the coins of the United States have been going on for nearly a year, and the various dies are approaching completion. As soon as finished, specimen coins will be struck and submitted to the Secretary of the Treasury for appropriate action under the law. One of the objects in view is to have the devices, inscriptions, etc., so finely engraved upon the coins as will render successful counterfeiting almost, if not quite, impossible. At the request of the Committee on Coinage, the Secretary has instructed the Director of the Mint to have an experimental $50 gold coin struck. These dies are nearly finished, and will, it is said, make the largest gold coin ever issued by any government. While on this subject I may state it is estimated by a prominent Treasury official that the total amount of gold and silver in the United States is $225,000,000, and that the increase during the year ending June 30 is not less than $45,000,000. As the imports are expected now to nearly, if not quite, balance exports, and the balance of trade is in our favor, it is believed that the accumulation of specie in this country will be still more rapid hereafter. Dr. Linderman, the Director of the Mint, expects to spend some time in California and Nevada investigating the gold and silver mines, to determine upon the supply of the precious metals which the government can count upon for coinage purposes. From a recent official report it appears that no small amount of gold and silver is obtained from the Atlantic coast, as the amount deposited at the mint and assay offices to the close of the fiscal year ending June 30, 1876, is as follows: North Carolina, $10,335,209.31; Georgia, $7,379,495.51; South Carolina, $1,381,521.06. Total $19,096,225.88.

An official comparative statement just issued of the exports and imports of the United States for the month ended May 31st, 1877, and for the eleven months ending at the same time, compared with like data of the corresponding year immediately preceding, in specie values, shows as follows: Excess of exports over imports, including merchandise and specie, for the month of May, 1876, $13,040,906. For the eleven months ending May 31, 1876, $103,109,473. For the month of May, 1877, $12,312,309. For the eleven months ending May 31, 1877, $166,372,093.

Recent railroad statistics show that 73,508 miles of road were in operation this year, against 71,759 in the previous year. The gross earnings, $497,558,000, against $503,066,000; the net, $186,453,000, against $182,506,000; dividends paid, $68,040,000, against $74,294,000.

There appears to be considerable doubt here about the Paris exposition being opened at the appointed time, although Secretary Evarts has received no official information as to postponement, but, on the contrary, all communications received from France give assurance that the exposition will be open next year as announced. Notwithstanding this, the opinion appears to gain strength in the State Department that a postponement will be decided on before long. In addition to the war now exciting all Europe, which is likely to prove an insuperable obstacle to holding a satisfactory international exhibition, there is now a new difficulty in the political crisis in France. The election which follows the dissolution of the assembly will greatly agitate the country, and would seem to make it impossible to develop that degree of interest in the exhibition essential to success in such a tremendous undertaking. In consequence of this no steps have been taken by the department toward organizing the provisional commission that has been heretofore proposed.

Mr. C. C. Andrews, our minister at Stockholm, informs the State Department that an agricultural exhibition will be held at Christiana, from the 2d to the 7th of October next, which will be open to foreign nations, and appropriate awards given to the successful competitors. The time of exhibition is short, yet it may be sufficient to introduce some of our agricultural implements to the notice of the farmers of that region.

Washington, D. C. OCCASIONAL.

Iron Bridges.

To the Editor of the Scientific American:

When a railroad train falls through an iron bridge, an iron truss sinks beneath the roof of a public building, and an engine boiler bursts at ordinary working pressure, all within a short period of time and each endangering, if not destroying lives—no wonder that some persons are led to ask whether we are not advancing too rapidly in the applications of art and without sufficient precaution. In perhaps no other branch of industrial science has a quarter century's research been so universally beneficial and of extensively practical a character as in metallurgy and uses of iron.

It is not unnatural, then, to suppose that iron would be the first of our artificial productions to come into too general use. Nor would it be anything but strange if some conservative voice did not rise to "brake up" our headlong rush to that unhappy state of things which would result in the mortification of science.

We have listened particularly to arguments (?) against the use of iron as a bridge material—against the replacement of the stone arch by the iron girder.

One remarks upon the loss of life by the Ashtabula disaster: "No such thing could have happened if that bridge had been a stone arch. Who ever heard of a stone bridge falling through?" Now the fact that stone bridges never fall (allowing such, for a moment, to be the case), while iron ones do, is no reason for abolishing iron as a bridge material. Let iron and stone bridges, under the same traffic, be built with the same safety factor, and the imperfection that will cause a downfall will, in nine out of ten cases, exist in the stone.

The fact that all iron before being used is molten, and therefore becomes homogeneous, is in itself a strong argument in favor of its use. Another is the ease with which a whole truss may be tested in one or two of its members before erection, while to test an arch would necessitate the awkward and tedious performance of testing each stone.

Stone bridges of long span, especially with us, are of comparatively rare occurrence. The voussoirs of a short span are, for looks alone, large enough to insure many times the requisite strength, and any mason who has an eye for symmetry and enough of that indispensable article known as "cheek" to style himself an engineer, may with safety to his own reputation erect an ordinary stone bridge.

The reason, then, why a stone bridge does not fall is because it is unnecessarily strong. Let iron be used as profusely and in correct proportions, and no iron bridge would ever fall.

Stone bridges as well as iron trusses, do fail when not securely built. An inspection of the Boston Railroad depots will show the remains of an arch whose load is supported by an iron girder. Even while we are many times safer in the railway car than in our own private carriage, we cannot doubt that iron, especially in trusses, is sometimes too sparingly used.

It is asked: "Is not some legislation necessary to prevent such rapid introduction of iron bridges upon our thoroughfares?" I say, "No."

But let us have legislation that will be a damper to the erection of cheap bridges by money-eyed corporations, and that will, without excessive material, as in the case of stone bridges, give the passenger over the suspension or truss bridge the same feeling of security as when over the arch. In the above-mentioned, as in all such cases, failure was due to incompetent or untrustworthy engineering rather than to the iron.

In what respect is iron inferior to any other bridge material?

Let iron be used, then, but let men use it who will prove it free from silicon, phosphorus, etc., before computing for pure bar iron.

Marston's Mills, Mass. H. V. HINCKLEY.

Instinct of the Swallow.

To the Editor of the Scientific American:

On page 407, vol. xxxvi., of THE SCIENTIFIC AMERICAN, Thos. Edward gives an account of the conduct of the tern. Having seen a similar display among barn swallows, I am prepared to believe the narrative.

A swallow, on rapid wing, thought to take an insect near the water. His wing dipped, and not being properly on his guard, he was turned on his back, and floated like a cork on the surface, feet up, and perfectly helpless. He uttered a few cries of distress, and almost instantly a multitude of deeply-sympathetic companions filled the air above and around him, each clamorous with excitement, and all running to realize the situation, and to comprehend what was required, but many fruitless efforts were made before he was successfully caught by the wings, raised, and partly turned over. They were finally successful, and I was left standing on the bank, meditating over the popular errors in regard to instinct and reason. S. L. N. FOOTE, M.D.

Yellowbud, Ohio.

Enemy of the Potato Beetle.

To the Editor of the Scientific American:

I send by mail a small box containing a bug which seems to be a new destroyer of the Colorado beetle, or potato bug; it has a proboscis somewhat resembling the house-fly, but seems to be of a hard nature like bone. The bug strikes the beetle with this proboscis, and seems to suck the life out of it, when he is ready for another. First, Would like to know whether it is an injury to the potato plant; Second, What

class of beetle it belongs to, with its proper name. It seems to be a new discovery. I have not had time to watch it very much, but have seen it kill two bugs in ten minutes. Seems to destroy the most from three o'clock P. M. until dark. Would be pleased to have an answer through your paper.

Sandusky, Iowa. F. A. WHITNEY.

The rust-gray, angular, and somewhat flattened animal referred to in the above letter is not a beetle, but a genuine bug(order, *heteroptera;* family, *scutellerida*), popularly known by the name of the spined soldier-bug (*arma spinosa dallas*). It is an old acquaintance, and every reading farmer protects it as far as possible in his warfare with the potato beetle.

The specimen sent by Mr. Whitney was a female, and had just laid 22 eggs by the way. These eggs are pretty little cauldron-shaped objects, with a convex lid, around which ciliate from 15 to 20 delicate white spines. The color of the egg is at first pale bluish gray, but the shell being translucent, the black and red colors of the embryo within soon show through it, and give the egg a bronze hue. Carefully examined, the surface is seen to be studded, especially on the convex lid, with what, under the microscope, appear like blunt spines, and which give the egg a slightly specked appearance to the naked eye. The convex lid opens with a spring of marvelous delicacy, when the hatching period arrives.



SPINED SOLDIER-BUG—*a*, enlarged beak; *b*, bug with right wings expanded.

These eggs are neatly placed side by side, in clusters of a dozen or more, upon leaves and other objects, and are so much subject to the attacks of a minute hymenopterous parasite, that those who undertake to hatch such as are found out-doors will more often get flies than bugs.

The newly hatched bugs are broadly ovoid and swollen-backed creatures, which congregate together, and look quite unlike the parent. The color is polished black, except the abdomen, which is crimson, with transverse black bars on the middle of the back and at the sides.

In the full-grown larva, the black still predominates on the thorax, but some four yellowish spots appear, and the abdomen becomes more yellowish, though still tinted with red. In the pupa, which is readily distinguished by the little wing-pads, the ochreous-yellow extends still more, and finally, with the last molt, the black disappears entirely in the perfect insect. Throughout the immature stages the shoulders are rounded, and not pointed, and the antennæ, or feelers, have but four joints, instead of five as in the mature bug, while there are but two visible joints to the feet, or tarsi, instead of three.



SPINED SOLDIER-BUG.—*c*, egg; *b*, larva; *u*, pupa.

The writer thus speaks of this gallant little fellow in his work on "Potato Pests":

"This is one of the most common and efficient of doryphora's enemies, occurring in all parts of the country, and seeming to have a decided fondness for our potato-destroyer, especially for the soft larva. . . . Thrusting forward his long and stout beak, he sticks it into his victim, and in a short time pumps out all the juices of its body and throws away the empty skin.

"We have been taught to admire the muscular power of the lion, which is enabled to grip and toss an animal larger than itself with its powerful neck and jaws; but feats performed by these young soldier-bugs throw the lion's strength completely into the shade, for they may be often seen running nimbly with a doryphora larva, four or five times their own size, held high in air upon their outstretched beak.

"The spined soldier-bug by no means confines himself to potato-beetle larvæ, but attacks a great number of other insects."

Water Pipe Pressures.

A series of important experiments, having for their object the settlement of several important questions in connection with the extinction of fires, were carried out at Grays on behalf of the Metropolitan Board of Works by Sir Joseph Bazalgette and Messrs. Branwell and Easton, C.E. The experiments were classed under three heads, the first being to test the effect produced by a pressure of 40 feet (that being the greatest height above road level to which the East London Waterworks Company are required to deliver water under their Act), using various lengths of hose and sizes of jets. The second was to test the effect of varying pressures under differing conditions of hose and jets. The third was to experiment with jets of great height. The basis from which the experiments started was the assumption that the value of a jet for extinguishing fires will be according to the height to which it can be thrown and to the quantity of water delivered, both of which depend on the elevation or head of reservoir, the lengths and sizes of the mains and pipes, and the dimensions of the hose and jet. Thus three things had to be considered—namely, the pipe friction, the hose friction, and the ratio between the height of the jet and the pressure immediately producing it. The results of the experiments proved that in overcoming the friction due to driving 600 gallons of water per minute through one-eighth of a mile of 4-inch pipe, 225 feet of pressure would be exhausted. If these 600 gallons were separated into the four jets of 150 gallons, each with their 200 feet of hose, there must be added to the 225 feet the loss of 55 feet in delivering 150 gallons per minute; and to throw that quantity to a height of 50 feet by jet would exhaust a further 80 feet of pressure. The inevitable conclusion, therefore, is that to deliver these quantities through the stated lengths of pipe and hose, and to throw it to a height of 50 feet, would exhaust a pressure of 360 feet. It may be as well here to observe that one-eighth of a mile of 4-inch pipe appears to be a very long length for the delivery of so large a quantity of water, and, as shown by the second experiment, the reduction of the quantity of water to one-half reduced the pressure from 250 feet to 63 feet, 6 inches. A proportionate enlargement of the pipes to deliver the larger quantity of water would effect an equivalent reduction of pressure, so that with high pressures it is clear that at the same time there must be pipes of sufficient size not only for the delivery of water extinguishing fires, but also, at the same time, for supplying the domestic requirements of the surrounding district. It must also be borne in mind that if these high pressures are introduced into the metropolitan district, the whole of the house pipes and fittings must be strengthened so as to be able to withstand them. The cost of that alone has been estimated by Mr. Muir, of the New River Water Company, at £40 per house. As there are about 400,000 houses to be dealt with, that means an expenditure of somewhere about four millions of money.—*London Building News.*

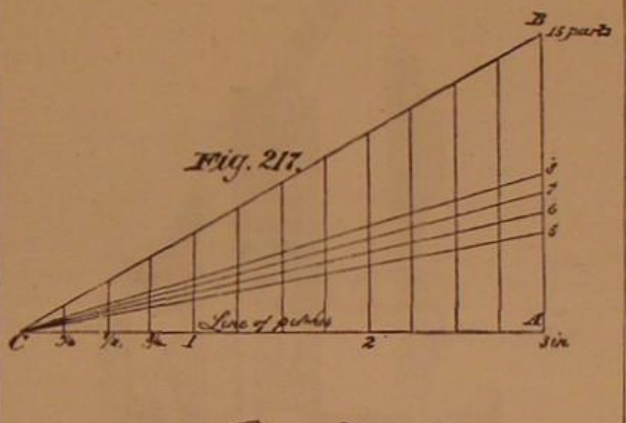
PRACTICAL MECHANISM.

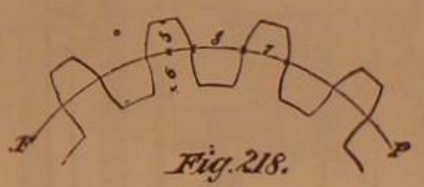
BY JOSHUA ROSE.

NEW SERIES—No. XXX.

PATTERN-MAKING.—WHEEL SCALE.

The accompanying illustration (Fig. 217) represents a very serviceable article for those who may be called upon to lay out gearing. It is not new to the mechanical world, but as the author never happened to meet with but one man who actually had made himself a scale of this kind, he considers it will prove a novelty to a large class of the readers of THE SCIENTIFIC AMERICAN.





Draw the lines AB and AC at right angles to each other. Make AB equal to three inches; the line AC may be any convenient length, say six inches, as by observing this proportion the scale will be in addition a very useful set square with the angles at B and C 60° and 30° respectively. Join BC; divide AB into 15 parts; from C draw lines to the fifth, sixth, seventh and eighth part, as in the figure. Divide AC into as many parts as there are inches in AB, number the divisions, and erect perpendiculars to AC. These are for the even inch pitches. To make the scale serviceable for the fractional parts, divide and subdivide again, and erect a perpendicular at each division. This process in our figure is carried out to quarter inches. It may, however, be further extended, if desired; but inasmuch as it is so little trouble to draw a perpendicular at any time for any fractional pitch required, it may be preferred by some that the scale should not be overcrowded with lines.

Brass is probably the most suitable material, as it takes the lines readily, does not oxidize, and is sufficiently hard to stand considerable wear.

The method of using this scale will be clear from the following example. Let O, Fig. 2, be the center of a tooth wheel or pinion, and PP the pitch circle, which we will suppose already divided off, and that the pitch is one inch; on the perpendicular marked take with the compasses the distance up to line 5, and set this off outside the pitch for the tops of the teeth; on the same perpendicular take the distance up to line 6, and mark this inside the pitch circle for the roots of the teeth. With center, O, and the points so found as distances, describe circles.

Make the thickness of the tooth equal to the distance on the scale up to line 7; the width of the space will then be equal to the distance up to line 8—all of course measured from the base line, AC.

Scales upon this principle may be made to accommodate any preferred proportions of the teeth of wheels.

Naphtha Explosions.

At noon, May 28th, an explosion and fire occurred on a barge which was discharging naphtha in front of the pier of the Metropolitan Gas Company, on the North River, near New York city. There had been about 95 barrels in the cargo, of which about one-half was pumped into a receiving tank, and the accident occurred just as the engineer, who was on the pier, was about starting the donkey pumps for work, after the dinner hour. The captain of the barge and two men were killed, and the engineer seriously injured. The barge and pier were damaged to an amount of about $3,000, but the receiving tank, which was not far off, most fortunately escaped. It was unusual to receive the naphtha in barrels—it generally having been sent in bulk, and pumped to this same receiving tank. Possibly a pipe or match used by one of the men killed ignited the inflammable gas evolved from the naphtha, or a spark may have originated from the iron implement used to remove the bungs, striking a nail.

June 2d, an explosion took place at the residence of C. B. Shoemaker, 1504 Swain street, Philadelphia. Mr. S. had procured five gallons of "benzine" to use as a moth preventive, and, with a watering-pot, had sprinkled the carpet and furniture of the parlor with the fluid. At 8·45 A.M., Mrs. Shoemaker and Mary Hall being in the parlor, a violent explosion occurred in the lower rooms, setting fire to the clothing of the two ladies, and causing the death of Miss Hall at noon of the same day, and of Mrs. Shoemaker about midnight of June 3d. The benzine in the can held by Mr. Shoemaker, in the second story at the time, did not ignite. There was no fire either in the parlor or dining room, and the only theory which seems possible is, that the volatile gas extending through the dining room to the kitchen—a distance of about 40 feet—and forming an explosive mixture with the air, ignited at the range in the kitchen.

At the coroner's inquest it was shown that Mr. Shoemaker had for four years past used benzine in a similiar way without accident. The can in the present case was labeled "Parlor Oil, Non explosive." The portion remaining in the can, upon being analyzed by Shippen Wallace, chemist, was found to be "a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha." The specific gravity was only 75° Baumé. In his testimony, Mr. Wallace said:

"It is extremely volatile, giving off inflammable vapors at the ordinary temperature, and can be ignited when a flame is held within half an inch of it. By submitting the fluid to distillation, I succeeded in obtaining 64 per cent below the temperature of 170° F., and the balance between that and 205°. In the process of refining petroleum, the oil coming over from the still at a temperature below 170° F. is termed gasoline, and has a specific gravity from 80° to 90° B.; I would therefore call the fluid a light naphtha, partaking, however, more of what would be termed gasoline, commercially, than naphtha. By the name 'naphtha' is, at the present time, by chemical writers, embraced most of the inflammable liquids produced by the dry distillation of organic substances; commercially, as applied to the products of petroleum coming from the still, between 150° and 278°, and having a specific gravity of 71°–76° B., while the liquid obtained below 150°, and which generally has a specific gravity of 80° to 90°, is termed gasoline."—*American Exchange and Review.*

Priming.

Never prime a piece of wood, especially hard wood, unless certain there is no moisture in it. Run all wheels out in the sun, or dry by artificial heat before priming, and if painted as described in hurried work, they will not scale, crack, nor blister. Use more or less oil, according to the time required for finishing; on slow work oil will take the place of varnish. Do not put on one coat and let it stand a long time without sanding, and never put a thick coat on bone dry work. A job painted in this way, with an extra coat of rubbing varnish, allowed to stand a week or more, then rubbed out and well varnished, and kept away from mud and water for one month, will hold its gloss equal to oil work, and will not crack nor have the small-pox, and come off generally. If necessary to hurry it still more, use more japan and varnish and less oil, thinning well with turpentine.

Do not put a dry flat coat on glossy oil, nor *vice versa*. Be sure your job is free from moisture, so that it will drink in the priming. Make your priming thin enough with turpentine, so that it is drink and not victuals. Make each coat as near like the last as possible, put them on as soon as dry, and they will form one solid coating; then if you have time, let them thoroughly dry before varnishing. For wood work to keep in stock a long time, prime with best pail lead, boiled oil and a little turpentine.—*Carriage Monthly.*

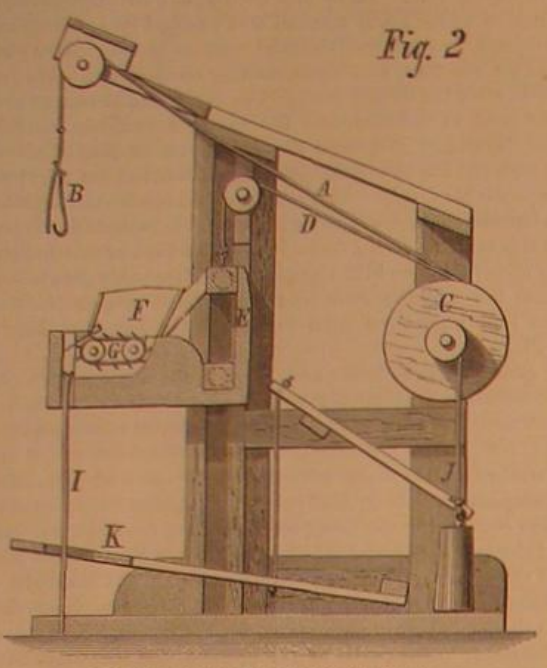
A Steel-Clad Bullet-Proof Car.

A car of this sort has recently been constructed at York, Pa., for the Spanish Government, for use in Cuba. The steel slides, which are pierced with loopholes for musketry, and which take the place of windows, have been so cunningly planned by the painter's skill to resemble the decorated ground-glass sometimes used in cars, as to deceive the unwary at a little distance. The car is 31 feet long, 8 feet wide, of the usual height, and is mounted on the Pennsylvania Railroad standard passenger car truck. Its weight is about 24,000 lbs. No finer work of the kind has ever been made.

IMPROVED HORSE COLLAR STUFFING MACHINE.

We illustrate herewith a new machine for stuffing horse collars, by means of which the work can be much more rapidly performed than is ordinarily the case. Fig. 2 is a sectional view, and Fig. 1 is a perspective view of the device.

Fig. 2



HORSE COLLAR STUFFING MACHINE.

To the upper portion of the frame is attached an inclined bar which carries a pulley, over which passes the rope, A, Fig. 2. Adjustably fastened to said rope is a hook, B, which receives the collar to be stuffed, as shown in Fig. 1. The rope passes back and is wound around a drum, C, generally in the rear portion of the frame. To this drum is also attached another rope, D, which, after passing over a pulley in the frame is fastened to a carriage, E, the wheels of which move up and down in ways in the frame.

The straw or other material is received in the hopper, F, secured to said carriage. The bottom of this hopper is a short endless belt, G, provided with teeth to grasp the straw and carry it forward into a recess in the front part of the carriage. A small arm suitably arranged prevents clogging of the recess. Upon one of the journals of the rollers over which the belt passes, is a pulley, H, which is connected to the roller journal by a pawl and ratchet wheel, so that only when said pulley is turned forward, the roller and belt may be carried with it. Around the pulley, H, passes a strap, one end of which is attached to one extremity of a coiled spring, while the other end of the spring is secured to the carriage. The opposite end of the strap is attached to a segmental pulley, which has a projecting arm to strike against a stop on the frame whenever the carriage moves upward to operate the feed belt, and which is drawn back to its former position by the spring as soon as it is released from the stop.

The rod, I, passes through a hole in the carriage to take the straw from the carrier belt and force it into the collar. To the shaft of the drum, C, is secured a rope, J, which is wound thereon in the opposite direction to that of the ropes previously mentioned, and which carries a weight large enough to overbalance and raise the carriage and its attachments.

The mode of operating the machine is as follows: The workman hangs the collar to be stuffed, as shown in Fig. 1, by one end from the hook on rope, A, and places the straw or other stuffing material in the hopper. He then holds the open lower end of the collar over the hole in the carriage and presses the treadle, K, down with his foot. This, through the intermediate mechanism, raises the weight and allows the carriage to descend, the operator drawing the collar down with it. As the carriage comes down, the rod, I, forces the straw into the collar. The workman then raises his foot from the treadle, the weight is lowered, and the carriage is raised. The ascent of the latter operates the feed belt and feeds more straw into the cavity of the carriage ready to be forced up into the collar as the carriage again descends. In this way it is claimed that a collar can be quickly, easily, and thoroughly stuffed.

Patented through the Scientific American Patent Agency, June 19, 1877, by Mr. John M. Lichliter, Page county, Va. For further information address B. F. Grayson, Jr., Luray.

Testing for Lead in the Glazing of Pottery.

The method employed by Ebermayer for this purpose is so simple that we give it entire. As we have previously stated, some of the so-called granite ware contains lead, and the same method may probably be adopted in testing utensils made of this ware. Ebermayer takes weak commercial vinegar, which he dilutes with four parts of water, and adds to each liter of vinegar 50 grains (or 5 per cent) of table salt. The addition of the salt might be entirely omitted, as the chloride of lead formed is but slightly soluble in salt water. If the glazing is good, it will not be attacked either by dilute vinegar or salt water; if it is poor, more lead will be dissolved by the vinegar than by the brine. The vinegar and salt is left in the vessel 8 to 12 hours. A measured quantity is employed, say ¼ liter, or ½ pint, and in repeating the test, use a little less of the liquid, so that it will not stand higher than before, and dissolve fresh portions of the glazing. After 8 or 12 hours, the contents of the vessel are tested for lead with sulphide of ammonium. If no precipitate of sulphide of lead is formed, or at most a light yellow to light brown color is produced, the vessel is not to be considered dangerous to health. If, however, a black precipitate, or dark brown color is formed, from which a precipitate falls in a short time, the glazing of such vessel is suspicious.

These vessels are then rinsed out with water, and again filled with the diluted vinegar. After 8 or 12 hours it is again tested with sulphide of ammonium. Those vessels which no longer yield any precipitate are to be regarded as good and fit to use. In these vessels there is nothing to fear provided they are boiled with vinegar and water before using. If a precipitate is formed a second time, the vessel is totally unfit for use, and dangerous to health.

A GASPIPE BEDSTEAD.

An ingeniously simple bedstead can be made of iron pipe in the manner illustrated in the annexed engraving. Two

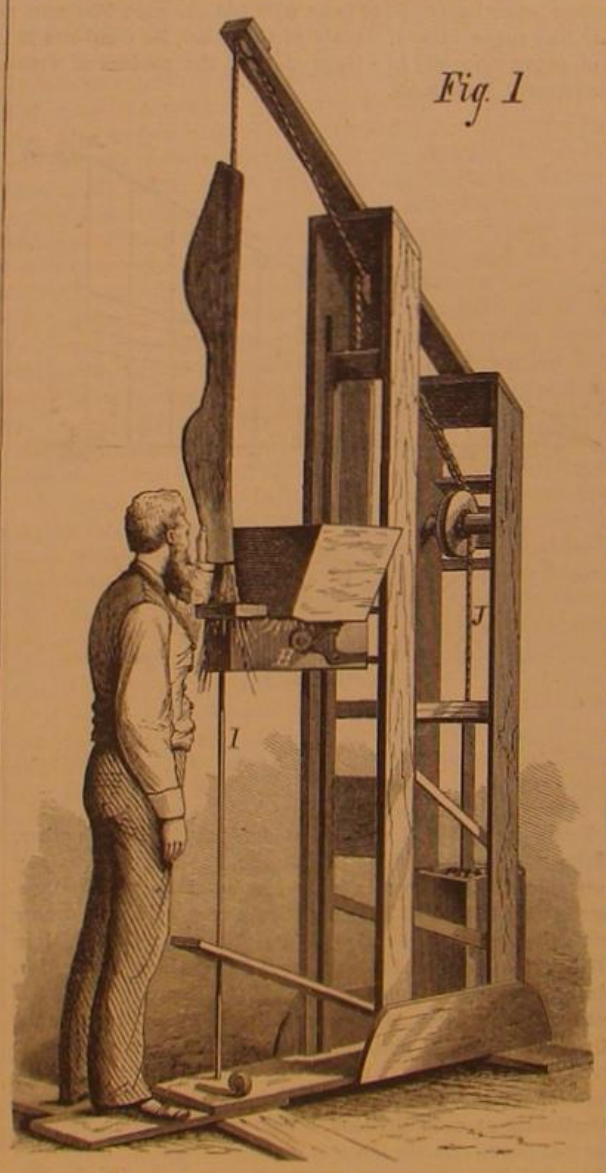
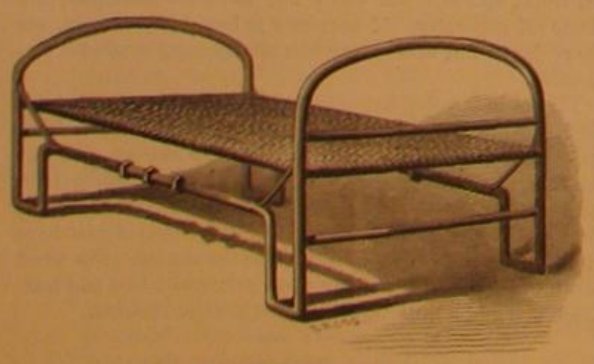


Fig. 1

HORSE COLLAR STUFFING MACHINE.



A GASPIPE BEDSTEAD.

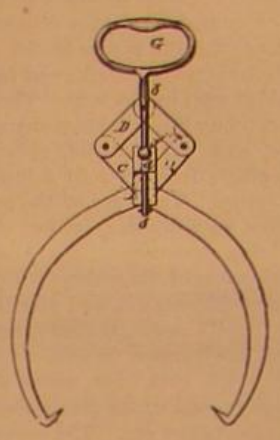
lengths of pipe are bent, each in the same manner, as follows: A distance equal to the desired width of the headboard is marked off at the middle of one of the pieces. Each end is then bent in U shape to form legs, and the arms of the U are bent at right angles to form side pieces. The other length of pipe is bent in precisely the same way. Then the two parts are joined by couplings on the side bars, braces are added as shown, a wire mattress is attached, and the bedstead is complete. This was patented April 24, 1877, by Mr. W. J. Myers, of Hartford, Conn.

Exportation of American Beef.

A statement is made by the Bureau of Statistics that during eighteen months ending with March, 1877, the total exports of fresh beef from the United States to Great Britain amounted to 34,278,810 lbs., the money value of which was $3,026,483. Of this amount 29,601,250 lbs. went from New York, and 4,677,560 from Philadelphia. The exportation has been gradually increasing, 36,000 lbs. only having been sent in October, 1875, and 6,707,855 in March last.

NEW ICE TONGS.

The annexed engraving represents a new tongs for grappling and hoisting or lifting any desired article. It consists of two bowed arms, pivoted together and provided at their lower ends with prongs. Above the pivot the arms form levers, C, crossing each other, as shown, and to the upper ends of these levers are pivoted two links, D, the upper ends of which are pivoted together to a shank, *b*, projecting downward from the handle, the parts together forming a toggle-joint. The handle shank, *b*, passes through a guide or projection, *d*, attached to a bar, I, which is pivoted to the tongs. From this guide or projection extends a knob, S, as shown. The tongs are operated by holding them with the handle, G, and striking them down upon the block of ice, for example, when the toggle joint spreads so as to open the arms and allow the jaws to take hold. Then, by raising the tongs, the ice is lifted by them, and the heavier the ice is, the closer the tongs hold it. By taking hold of the knob, J, with the left hand, while the right hand has hold of the handle, G, the arms can be opened easily and guided so that the jaws, B, can take proper hold of the ice.



This device was patented February 29, 1877, by Mr. Peter Euler, of Troy, N. Y.

New Metallurgical Treatment of Nickel.

M. Hersel proposes the following treatment of the oxides of nickel, and especially of the hydrosilicate of nickel and of magnesia. The nickel oxides are mixed with alkaline sulphides or persulphides, or with alkaline earths variable according to the composition of the ore and the nature of the gangue. The mixture is melted in a suitable furnace. The sulphides or alkaline earths react on the oxides and on the silicate of nickel formed by double decomposition of the nickel sulphide and the alkaline silicates. The gangue combines with the melted mass on the furnace hearth and produces scoriæ: from the latter the nickel sulphide is separated in the same apparatus. Fusion gives: 1. Sulphide of nickel freed almost completely from sulphide of iron. 2. Alkalies or alkaline earths in excess. 3. Silicates forming slag. It remains only to transform the sulphide of nickel into oxide and to treat the latter according to methods commonly known.

How the Chinese Make Tea.

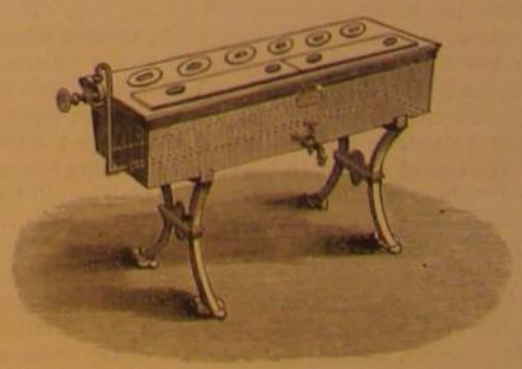
The upper classes in China, from very long experience in the matter, select the very choicest tea which they can afford—generally the young leaves from old trees. A few of these leaves are put into a cup, and water, a little short of the boiling point, is added. As soon as it is sufficiently cool, which does not take many seconds, for the cups are very small, the beverage is quaffed, much after the same manner as the Turks do coffee, so hot that it is commonly asserted they drink it boiling. By the above quick method, they skim, as it were, only the superficial flavor of the leaf, which is very capable of yielding up, when required, a bitter extract, which they avoid. This is the prime source where the "used leaves," spoken of by analysts, come from.

American Institute Exhibition.

The 46th Exhibition of the American Institute, New York city, promises to be of unusual value. Our inventors and manufacturers have at last learned the value of meeting the purchaser and consumer face to face. For rules, space, etc., address the General Superintendent.

STEAM GLUE-HEATING APPARATUS.

This apparatus has been devised by Messrs. W. Richardson & Co., of Darlington, England, to meet a want which has been felt in joinery shops and other establishments where there is a considerable consumption of glue. As will be



seen, it is a very simple affair. There is a cast iron pan or trough, which, when filled to about two thirds with water, receives a half-inch steam pipe, and when the water boils, the round covers on the top of the apparatus are removed, the glue cans being substituted. The oblong spaces in the top (also provided with covers) are intended to receive perforated zinc troughs for boiling the breakfast cans of the workmen. Hot water can always be had from the apparatus, and its use implies saving of material, trouble, and fuel.

TORPEDO WARFARE.

The Russian operations on the Danube are now inviting attention to this destructive arm of the service. We offer some illustrations of the chief of the present recognized systems. In so doing, it may be well to remark that experiments have rather been directed to the use of torpedoes at sea than to their employment for holding a river such as the Danube, about half a mile wide, against an immensely superior force. But the late daring feat of planting a torpedo against the side of a Turkish ironclad gunboat, will probably be followed by other equally hazardous and perhaps successful attacks, if the Turks are unwise enough to permit their ironclads or other vessels of deep draught to remain within those narrow waters. It will be observed, however, on the other hand, that the more recent failure of a similar attack on a Turkish ship at the Sulina mouth of the Danube, and the sinking of two Russian torpedo boats by the ship's guns, has moderated some of the opinions that were expressed a week or two ago concerning the irresistible power of this novel instrument of warfare.

In the annexed engravings, from the London *Illustrated News*, we illustrate several of the most improved forms of torpedo vessels. The Whitehead fish torpedo is separately depicted in Fig. 4. This machine is a cigar-shaped steel cylinder, 14 feet to 19 feet in length, and from 14 inches to 16 inches in diameter. It is to be sent, requiring no crew, against the ship to be destroyed; and if one torpedo fails to deal the death-blow, another and a third can be sent after the enemy without much trouble or expense. This torpedo consists of three compartments—head, center, and tail. The head contains the explosive, say 360 lbs. of gun cotton; the central chamber holds the machinery and mechanism for regulating it, so as to remain at the depth at which the torpedo is to travel under the water line; and the third part holds the supply of compressed air for the engine. The motive power is supplied by a small engine, capable of indicating 40 horse power, but so compact that it can be made to weigh only 35 lbs. The working pressure of the air in the tail is usually about 1,000 lbs. per square inch; and the quantity carried is sufficient to propel the large torpedo 200 yards at a speed of twenty-five miles an hour, or about 1,000 yards at a speed of seventeen miles.

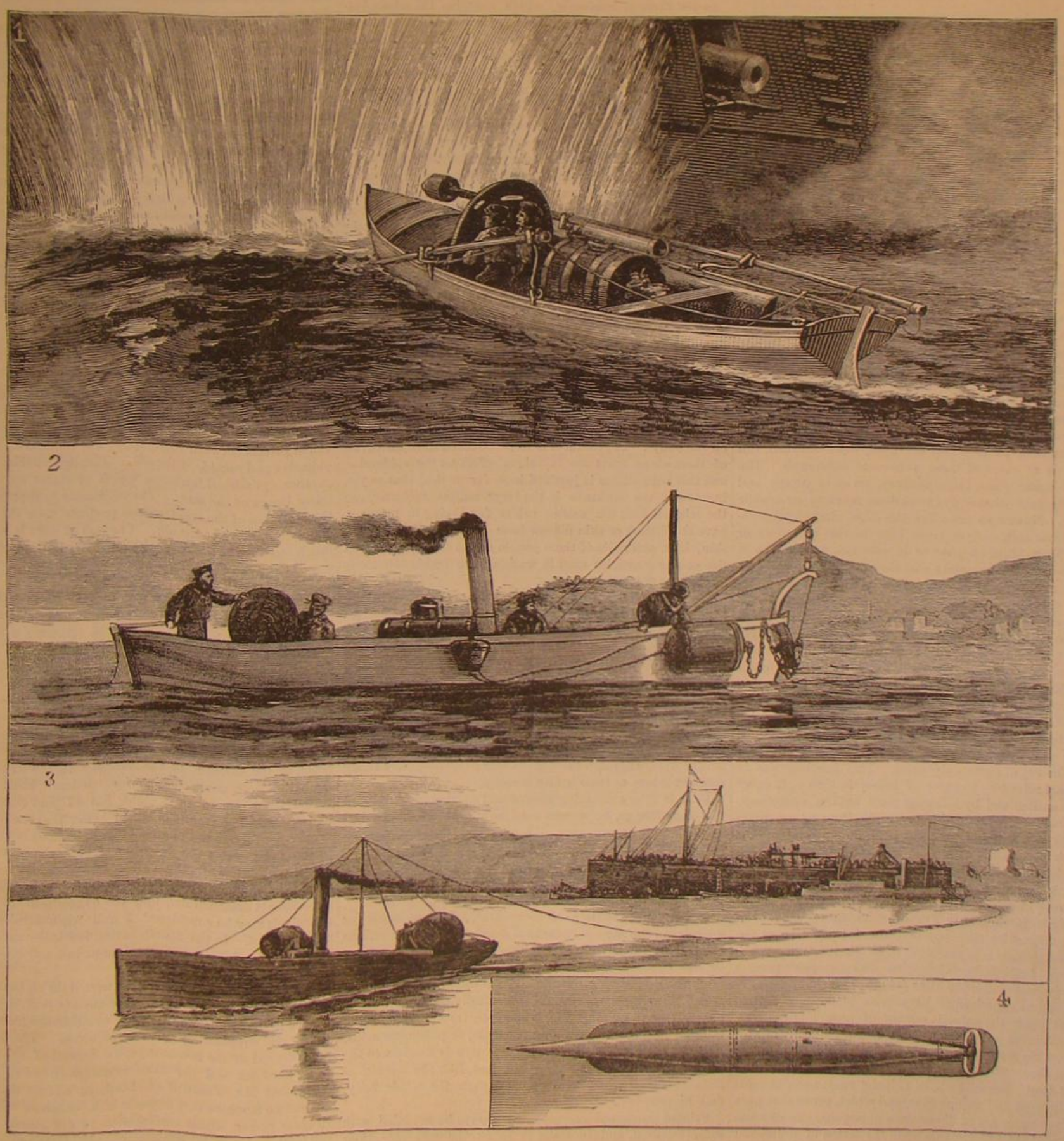
A fish torpedo should be capable of piercing the protective nets that are suspended from booms around an ironclad. Whether such nets, made of rope and wire or any other material, will effectually keep off the torpedo remains to be seen. But probably, if the net is sufficiently strong to keep out the Whitehead torpedo, or to divert its course, this net will be so heavy as seriously to impede the manœuvering power of the big ship, and expose her to the equally great danger of being rammed. Outrigger torpedoes, made of wood or steel, may be carried by large vessels over the bows or sides, either attached to booms above water or propelled through cylinders below the water line, as just described. They can be fired on contact, or at will, by electricity.

Small steam launches, Fig. 3, propelled by steam, or other motive power, and steered by electricity, either from the shore or from a large vessel, or by one man on board the launch, and carrying one or more of these torpedoes, will prove most formidable. They may be used even in a general fleet action, fought in mid ocean, if the water be sufficiently smooth. Generally they will be manned by a crew, and, under cover of gunsmoke or the darkness of night, will be likely to render a good account of their work.

It has been suggested that Holmes' distress signal, capable of emitting a very strong white light at a distance of more than a mile, or some other illuminating power, may be employed by the enemy's ships to discover the movements of torpedo attack. But it is most unlikely that any of the big ship's guns could hit one of these steam launches. And the mere fact of the big ship having to fire these shots would disclose her position, and would, instead of being a detriment, aid the approach of the torpedo boat armed with these infernal machines. It is difficult enough by daylight to hit one of these fleet little vessels; but in comparative darkness, or with a flickering light, it becomes the merest chance whether the gunner, even when thus forewarned, could bring his gun sights to bear upon them. As means, therefore, of defence against the most powerful ships of war, it may be sufficient for ordinary vessels to carry one of these torpedo boats either at their davits or in special compartments, with a few torpedoes, keeping them in readiness to detach at a moment's notice.

The explosive—usually gun cotton—held in a tin receptacle, and secured to the boom end of the torpedo, is fired on striking the vessel's side, Fig. 1, or by electricity, when within a few feet of it; the length of the spar being so arranged that the explosion does not injure the launch carrying it. For this purpose a bow screen is fitted to prevent the upheaved water coming on board the launch. A charge powerful enough to sink an ironclad can be fired at a distance of 20 feet from the bow of the launch without damage to the launch or its crew.

Another illustration, Fig. 2, shows a launch placing torpedoes or submarine mines. Such defences are of great use in protecting a harbor or shipping of inferior force from the



ILLUSTRATIONS OF TORPEDO WARFARE.

fire of an enemy. This class of torpedo consists of an iron cask, part of which contains the charge and fuse, and the remainder is the air space for buoyancy. It is held in position, a few feet beneath the surface of low water, by a chain, which is secured to an iron mooring block. Two or more lines of mines are necessary: they can be fired by the enemy striking them, or by electricity at the desired moment when two observers, stationed at points well situated for getting lines of intersection, note the enemy exactly over the position of a mine. Each torpedo might contain 250 lbs. of gun cotton. We may suppose 100 feet spaces to exist between neighboring mines on the same line, and some 500 feet spaces between each of the lines crossways, over which series of two or three independent lines an enemy would have to pass before entering the harbor. Should the first explosion fail, the torpedo on No. 2 line will be fired as soon as the vessel crosses, and finally, if necessary, the torpedo on No. 3 line. The inside line would usually be supplied with circuit closers in addition to the means of firing them on cross bearings and signal; these circuit closers being always rendered active when darkness or thick weather sets in. To insure the greatest accuracy in firing the torpedoes by cross bearings, telescopic firing keys have been designed, so that all that is necessary is for the observers to watch the approaching vessel through the spyglass, and, whenever its movement brings the firing key over one of the points, the position of a mine, to press it down to close the break in the circuit.

The only way to clear an entrance into a harbor through this defence is by means of countermines suspended from casks or buoys, drifting them either by the current or the wind into the desired position, and then exploding them. A charge of 500 lbs. of gun cotton is calculated to destroy all submarine mines within an area having a radius of 120 yards.

ARE THE ANILINE DYES INJURIOUS TO HEALTH?

This important and interesting question has been answered in various ways, affirmatively, negatively and equivocally. H. Seidler, technical director of the mineral water establishment at Riga, delivered a lecture recently before a scientific society of Riga, from which we abstract a few important points:

In testing whether aniline colors are poisonous the following questions may be asked:

1. Are the dyes made of materials which are of themselves poisonous?

2. Does a certain quantity of these injurious substances remain in the dyes when finished?

3. Can the chemically pure dye itself act as a poison?

4. Is food colored with the pure dye poisonous?

5. Do fabrics (such as clothing and carpets) dyed with these dyes, exert a poisonous influence on the body?

1. In answer to the first query, he says: In the manufacture of aniline dyes, or more correctly, of rosaniline dyes, crude products are employed which do exert a very poisonous effect upon the animal system. Nitrobenzol, aniline oil, and the different oxidizing agents, such as mercurial and arsenical compounds, are extremely poisonous substances.

2. By careless purification, the dyes, when finished, can contain one or more of these poisonous substances. The dye may, under some circumstances, act as a poison and produce forms of disease due to aniline, mercury, or arsenic poisoning. Numerous cases like this have already been noticed. If the aniline dyes come into market in a more or less amorphous state, *en pate*, or in solution, we can almost always assume with certainty that they contain more or less of those poisonous substances employed in their manufacture. If they are sold in a dry state, either in powder or beautiful crystals, they are more likely to be pure, although arsenic may always be present, as the purification of dyes made with arsenic acid is tedious and involves inextricable difficulties and expense. The most carefully purified brand of dye, the Oa of Gehe & Co., Dresden, contains $\frac{1}{80000}$ part, or .00125 per cent of arsenic.

A number of technical chemists have attempted to drive out arsenic acid and other poisonous metallic compounds from the aniline manufacture, and have sought to work without the use of these substances. This problem was in greater part solved by Coupier of Poissy in 1869. Coupier made the aniline red by allowing pure aniline, nitrotoluol, hydrochloric acid, and a little metallic iron, to act upon each other at a suitable temperature. Commercial aniline oil, which is a mixture of aniline and toluidin, mixed with commercial nitrobenzol and nitrotoluol, may be employed with the hydrochloric acid and iron. The red obtained in both cases is identical with ordinary red. Meister, Lucius & Brunnig in Höchst, near Frankfort-on-Maine, have overcome the difficulties that opposed the introduction of the nitrobenzol process into practice. The Berlin Actiengesallschaft fuer Anilinfarbenfabrication uses Coupier's process exclusively, and makes 200 kilos (440 lbs.) of rubin daily.

3. Numerous experiments have been made in regard to the effect upon the animal system of pure aniline dyes, which contain no poisonous substances mechanically mixed, and are not the salts of a poisonous acid combined with the base rosaniline. First of all must be mentioned the experiments of Prof. Sonnenkalb, in Leipsig, made upon animals with aniline red and aniline blue, and which prove that pure aniline dyes never are of themselves poisonous. Seidler has now repeated the experiments upon the action of aniline red upon the system, and indeed upon himself, for he did not then know that experiments had been made with aniline red upon human beings. In his experiments he employed aniline red (Rubin from Brueckner, Lampe & Co., Leipsig) made by the nitrobenzol process. A qualitative analysis showed the absence of any metallic compound whatever. Doses of 0.05 grains (.75 grains) or of 0.1 grain produced no uneasiness, and when ½ grain was taken every morning for five weeks, not the slightest injurious consequences were perceptible. Experiments were made on two other persons with like results. This proves pure aniline dyes to be innocuous. The experiments permit of the supposition that Rubin (aniline red) passes through the animal system as indifferent matter, and is removed in a short time (two or three days) with the excrement undecomposed.

4. The answer to the query whether food colored with a pure aniline dye is poisonous is answered by the above. If the pure dyestoff is *per se* non-injurious, liquors and lemonade colored with it cannot exert any injurious effect upon the body. We have only to consider how extremely dilute these dyes are when used for coloring. Aniline dyes are never used to color drinks in such concentration that their consumption would approach any such quantity as that taken by Seidler, without injury.

The divisibility of this dyestuff is very extraordinary, a solution of 1 part aniline red in 1,000 parts alcohol, is very dark red; 1 part aniline red in 10,000 parts alcohol, is very red; 1 part aniline red in 100,000 parts alcohol, is red; 1 part aniline red in 1,000,000 parts alcohol, is distinct pink; 1 part aniline red in 10,000,000 parts alcohol, is pale pink; 1 part aniline red in 100,000,000 parts alcohol, gives an imperceptible coloration, which can be seen by holding a white screen behind the vessel containing the solution.

This divisibility is employed for the greater part in coloring drinks, as lemonade, liquors, etc.

In 100 liters of lemonade, which contains 135 whole bottles of lemonade, there are 13 c. c. of a 1 per cent. solution, so that there is less than a milligram (or $\frac{1}{15}$ grain) of aniline red dissolved in a bottle of lemonade. Hence, a man would require to drink 100 bottles of lemonade to obtain as much aniline red as Seidler and another person took at once in a concentrated form.

The question involuntarily presents itself, can the arsenic in fuchsin be injurious, if the aniline colors are employed in such extreme dilution for coloring drinks, etc.? This is best answered by a simple example. Suppose a manufacturer colored his spirituous liquors with fuchsin containing 10 per cent. of arsenic, a case which never happens. A person that consumes 100 c. c. (nearly a gill) daily would take only 0.02 milligrams (.003 grain) of arsenic. This quantity cannot be considered injurious.

If a careless manufacturer colored his lemonade with analine red containing 1 per cent. of analine, each bottle of lemonade would contain ·01 milligram (·00015 grain) arsenic.

For coloring eggs, aniline red is employod in a concentrated form. Here it is ordered that the purest possible dye, free from arsenic, must be employed, and druggists are only allowed to sell pure wares for this purpose. The presence of 0·00125 per cent. of arsenic could do no harm.

5. Have fabrics dyed with aniline a poisonous influence on the body? In general it is to be assumed that pure dyes, of themselves, exert no injurious effect on the epidemics, and this supposition is justified in so far as this, that as yet, in none of the workmen in the large aniline factories, nor the laborers that use aniline colors for dyeing or printing, have any illness or skin disease been observed, although the skin, hair, and nails of these people are so deeply dyed that the ordinary articles used in washing are unable to remove the intense coloration.

We have farther to consider that the aniline dyes belong to the class of so-called substantive dyes, that is, themselves possess the power, without the aid of mordants, of attaching themselves to the fibers, and cannot be dusted away by mechanical means, as for example, ball dresses, curtains, carpets, etc., dyed with arsenite of copper—Paris green.

Farthermore, we have as yet no perfectly-well authenticated cases where experience could justify the supposition that wearers of clothing of wool, silk, or cotton, dyed with aniline dyes, although their use is very extensive, have really suffered injury to their health thereby.

Even if dyes containing arsenic and aniline are employed in dyeing fabrics, no danger need be apprehended. In dyeing, it is well known, that all kinds of goods are very carefully washed before they come in the market; and, farther, it does not seem probable that fabrics dyed with these would contain aniline as such, or metallic salts, after such washings, in quantities sufficient to injure the skin.

If the fabrics dyed with these dyes afford no cause for uneasiness, the same is not true of goods printed with aniline colors. In the latter case, the dye is employed in a more or less concentrated form, and it is quite possible that it might be rubbed off mechanically, and thus enter the mouth, stomach, and intestine canal. Chemically pure dyes are, of course, free from danger. If, however, the aniline dye contains a considerable quantity of arsenic, or poisonous acids, like picric or oxalic acids, or if the dye is fixed on to the goods by means of a poisonous mordant, like the arsenite of soda, or of alumina, the skin, and even the whole body, may be poisoned.

Printed goods and carpets must always be regarded with some mistrust, and in order to be on the safe side, their harmlessness must be proven by a chemical analysis.

If a chemist wishes to test an aniline dye, or fabrics dyed or printed with aniline colors, in regard to their effect on the health, he should not be satisfied with testing for arsenic or other metallic poison, but must also test whether the dye in question is not combined with a poisonous acid, like oxalic or picric.

Novelties Before the French Physical Society.

At a recent session of the French Physical Society, papers, of which the following are abstracts, were presented:

RESISTANCE OF THERMO-ELECTRIC BATTERY.

M. Rolland has studied by Thomson's method the resistance of the clamond thermo-electric elements. His observations are represented by a curve having for abscisa the time and for ordinates the resistance of the element. During the first twenty minutes the curve rises, describing several sinuosities and then becomes parallel to the axes of abscisa. When the heating ceases the curve rises at first very rapidly and then descends oscillating. M. Rolland remarks that the method employed supposes the electro-motive force to be constant, and that consequently the curve may be the result of the variation of the resistance and of that of the electro-motive force. The progress of the temperature similarly observed on a copper-iron pile is represented by an analogous curve.

A NEW SYSTEM OF ELECTRIC TELEGRAPHY.

M. Thomasi presented a new system of electric telegraphy applicable to submarine cables of great length, which is essentially as follows: There is a new relay, the sensitiveness of which is such that 5 per cent only of the current of a single Minotto element, after having traversed a resistance equal to that of 2,520 miles of transatlantic cable, and a plate of wood lightly moistened (which represents a much greater resistance), suffices to cause it to act on the printing receiving instruments with the greatest rapidity. A second relay termed interrupter, automatically interrupts the current of the local battery after each emission, hindering a spark from being produced in the first relay. This spark, which may occasion inconvenience in a very delicate apparatus, such as the first relay, produces none in the second, because of the energy of the contact, which renders the consequences of the spark absolutely inoffensive. This relay acts in turn on the printing apparatus and on another local battery. The receiving instrument (Morse system, modified) is composed of two electro-magnets, which operate converging metallic points. One point impresses a red and the other a blue trace on the same band of paper, according as the operator transmits the Minotto current in positive or negative direction. Different combinations of these red and blue marks indicate numbers, letters, words, and even entire phrases. The transmitting apparatus automatically reverses the current after each emission, and the emissions are exactly of the same duration.

NEW STELLAR SPECTROSCOPE.

M. Mouton presented a spectroscopic telescope designed for stellar observation. The instrument is quite small, and may be adapted to telescopes of any kind. It consists essentially of a small telescope containing one or more direct vision prisms between the eyepiece and objective. Near the objective and outside is the slit. Finally, outside the slit is another cylindrical telescope which produces on the slit a linear image of the star. The collimator is suppressed and the objective of the spectroscope projects upon the eyepiece simply the image of the slit. The loss of light is said to be much less than is the case with ordinary spectroscopes.

New Investigations on Electro Deposition.

At a recent session of the French Academy of Sciences, M. Jamin presented, in behalf of M. Gramme, a note containing many new facts relative to the weight of galvanic deposits which may be obtained per unit of mechanical work by using the magneto-electric machines of which M. Gramme is the inventor. Four series of experiments are summarized. In the first the baths, in variable number, were coupled as for quantity. The results showed that the deposit per foot-pound of energy expended does not vary with the augmentation of the surfaces of the anodes. In the second series the baths were connected as for tension. Their number varied from one to forty-eight, but all had electrodes of like extent. The results obtained prove that the deposit of copper per foot-pound augments with the number of baths. In the third series the intensity of the cement was maintained constant, while the surface of the anodes and, at the same time, the number of the baths were augmented. These experiments demonstrated that the expenditure of work in eletrolysis may be considered as null when soluble anodes are employed. In the fourth series, insoluble anodes were used. A smaller deposit per foot-pound and considerable polarization resulted.

M. Gramme's note throws some new light on the question of galvanic deposits, and his experiments will be of much service to the industries in which magneto-electro-machines are rapidly supplanting galvanic batteries. The first apparatus densed by the inventor gave a deposit of 123 grains of silver per hour and per kilogrammeter (7·04 foot-pounds). At present Mr. Wohlwill of Hamburg reports that he has a Gramme machine that deposits 94 6 pounds of silver with 15 horse power, which corresponds to 616 grams of silver per hour and per kilogrammeter. M. Gramme considers that by the aid of his recent investigations he will be able to obtain a deposit above 3,080 grains per same units.

On Some Properties of Glass.

Glass—whether in the form of the lens in the camera or the support for the film in the negative, or, indeed, in any of the many shapes in which it is applied to photographic use—is looked upon as a substance of such complete permanency and unalterability that it is possible we may be thought guilty of exaggeration when we say that to find a glass which has a just claim to this popular opinion is very far from being an easy matter. That form in which the unblemished character of glass appeals most to the photographer is, naturally, the negative plate, of which some hundreds of thousands must be used annually; and so much does the common idea rule manipulative practice that it is scarcely too much to say that it is more than likely that the poor, much abused bath is credited with many a vagary when it is perfectly innocent, and some chemical alteration of the glass is the source of the evil.

That glass is so liable to be altered a little reflection upon the difficulties found in plate cleaning will show; for when a case arises where stains, etc., unmistakably point to the glass as the cause, it is evident its surface has not been mechanically abraded or scratched, and the change, whatever it is, must be of a chemical origin, though, possibly, mechanical in its immediate effect upon the deposition of the silver forming the image. We purpose to give some idea of the character of the metamorphosis likely to be undergone by glass when exposed to the action of air or water. Forewarned is to be forearmed, and the deeper we are able to dip into the source of failures the more power do we obtain to prevent them.

Glass forms an interesting example of the fact that, whenever special excellence in a particular direction is to be attained, it must usually be at the expense of some quality or other. The various characteristics of glass—its hardness, lustre, permanency, insolubility, impressibility, etc.—prove this. It is in the main a silicate of soda or potash, or both, having combined with it other silicates, such as those of lime, alumina, baryta, etc. There is a glass made (silicate of soda) which is quite soluble in water—it has a beautiful sea green hue as generally found in commerce—and between it and the most insoluble varieties, containing silica and aluminium in large proportion, there are all varieties of solubility to be found. Silicates of lime or potash separately are acted upon by water and acids, but, fused together, they are insoluble. The greater the proportion of silica and alumina glass contains the more insoluble it becomes, and it is the manufacturer's province so to proportion the ingredients of his glass as to produce qualities most suitable for the object in view. In this country glass manufactured in Germany, France, and at home is to be purchased, and each has its peculiar characteristics. An extremely pale glass, almost colorless, was imported a number of years ago from Germany; but it gave way to the action of the atmosphere to a most remarkable extent, and we have for some years seen nothing of it.

It has frequently been stated that glass with an artificial surface—that is, one produced by polishing with abrasive powder—is less clean to work and more liable to stain than one with the natural surface first obtained after the sheet has cooled down. Though we believe it quite possible that more has been made of this difference of surface than the actual facts warrant, we can yet easily see why, apart from the supposed hardness of the hypothetical skin, artificially polished glass should be more readily acted upon by water or other chemicals. This surface being entirely given by a process of rubbing, or, as it were, minute scratching with a powder, it might be supposed that if it could be examined by a microscope it would be found rough like "obscured" glass, and thus offer a greater amount of surface to be acted upon.

The action of water upon glass is to decompose it, the potash and soda and a little silica being dissolved, and the greater the amount of alkali present the quicker is the decomposition brought about. The action of the atmosphere is of a similar nature, the moisture always present to a greater or less degree being the real active agent; the common result is to separate the soda and potash, and to leave the silica upon the surface sometimes in a manner that is only perceptible upon heating, when excessively minute flakes separate and leave a dull surface. It has been stated that glass buried deep in the earth has been, when dug up, so soft as to be cut with a knife.

The use of soda for cleaning old glass plates is often recommended, and in its way, and with proper precautions, it very useful; but it is to be remembered that it dissolves the silica of the glass, acting with greater or less effect according to its strength and temperature. If this be borne in mind many troubles will be avoided, numerous cases of ineradicable stains having been traced to overlong soaking in alkaline solutions. If proof were needed of the solvent and injurious powers of small quantities of water, if continued for a sufficient length of time, it will be only necessary to breathe upon one half of a piece of patent plate glass, and, after immediately covering the film of condensed moisture by another plate to wrap up the two, place in a cold place for a twelvemonth, and then examine. The moistened part will be roughened to such an extent as almost to take the mark of a blacklead pencil. We have seen packets of several gross of plates entirely ruined from this cause; glass plates brought up of a cold store room into a damp atmosphere had condensed the moisture of the air upon their surfaces, and the packer had packed them without wiping them, as, indeed, it was scarcely likely he would think of doing. They remained immersed for a considerable time, and when opened were found to have the surface visibly eaten into, not a glass remaining that was fit for use; and there cannot be a doubt that there must be large quantities of glass similarly injured, though, unfortunately, not visibly so, the mischief only being observed after taking the negative.

Again: if further proof were required of the solubility of glass—that is, its decomposition, which must result in disintegration and thus roughen the surface, if even microscopically, and render it liable to retain foreign matter—it would be found by boiling in a Bohemian glass vessel a weak alkaline solution in which litmus had been dissolved and acid afterwards added to produce a faint reddening. The result would be that sufficient alkali would be dissolved out of the glass to restore the blue color to the litmus. This same experiment can be proved in a homely way by adding a little red cabbage to distilled water, and boiling in such a vessel, when the distinct blue of the alkali would be given to the water.

We think we have advanced sufficient facts to show that glass is by no means the unalterable substance so commonly supposed. If it induce a little more care in the use of this necessary photographic adjunct our purpose will be served. —*British Journal of Photography.*

Stove Blacking.

We hope the following receipt for imparting to stoves a fine black polish, which will neither burn off nor give out an offensive smell, will prove acceptable to some of our readers: Lamp-black is mixed with water-glass (a solution of silicate of soda) to the consistency of syrup and applied with a brush as a thin and even coating, then left twenty-four hours to dry. Afterwards graphite, or black lead mixed with gum water, is applied, and a polish obtained by rubbing in the usual manner.

A CEMENT for meerschaum can be made of quicklime mixed to a thick cream with the white of an egg. This cement will also unite glass or china.

Inventions Patented in England by Americans.

June 15 to June 21, 1877, inclusive.

BOOT SEWING MACHINE.—G. V. Sheffield *et al.*, Brooklyn, N. Y.
CHECK REGISTER.—L. Von Hoven, New York city.
CUTTING SHEET METAL.—G. A. Perkins, Philadelphia, Pa.
INDICATOR FOR CAR FARES.—L. Von Hoven *et al.*, New York city.
IRONING MACHINE.—T. S. Niles *et al.*, Troy, N. Y.
METAL TUBES.—J. E. Folk, Brooklyn, N. Y.
NEEDLES.—S. Peberdy *et al.*, Philadelphia, Pa.
RIVETING MACHINES.—J. F. Allen, New York city.
SCAFFOLD FRAME, ETC.—W. Murray, Vicksburg, Miss.
STEAM AND AIR ENGINE.—W. Mont Storm, New York city.
TORPEDO PROTECTION.—J. T. Parlour, Brooklyn, N. Y.
TOY.—C. W. Frost, Philadelphia, Pa.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

OIL PATENT.—JOSHUA MERRILL, APPELLANT, *vs.* DAVID M. YEOMANS AND DANIEL J. GOSS, AS D. M. YEOMANS & GOSS.

[Appeal from the Circuit Court of the United States for the District of Massachusetts.—Decided October Term, 1876.]

A patent for a process is not infringed by the sale of an article similar to that produced.

The claims in a patent are to be considered as distinct from the description contained in the specification, and as representing what part of the matter described the patentee claims as his invention, and for which he asks protection.

Inventions or discoveries are usually improvements upon some existing article, process, or machine, and are only useful in connection with it. It is necessary, therefore, for an applicant to describe that upon which he engrafts his invention, as well as the invention itself.

When the invention is of a new combination of old devices, it is necessary to describe with particularity all the old devices, and then the new mode of combining them.

While it is essential that the specification should describe such matters, both old and new, as are necessary to an understanding of the invention, the claim must contain a distinct and specific statement of what the applicant claims to be new and of his invention.

One who proposes to secure a monopoly of certain inventions at the expense of the public should set forth with clearness and precision the thing which no one but himself can use or enjoy without paying him for the privilege of doing so.

In a claim to "the above described new manufacture of the deodorized heavy hydrocarbon oils suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from hydrocarbon oils, by treating them substantially as is hereinbefore described," the word "manufacture" may be used to express the process or the product thereof, but when taken in connection with the words "by treating them substantially as is hereinbefore described," it renders the claim in effect to the new mode of manufacturing hydrocarbon oils by treating them as hereinbefore described.

The inventor of an article is entitled to protection therefor, however produced, and there is no reason why an applicant for a patent, if he had in his mind a claim for the article produced, should limit his claim by a description of the process.

The courts are inclined to give a patentee the benefit of a liberal construction of the patent, and when it appears that a valuable invention has really been made, to uphold that which was invented, and which comes within any fair interpretation of the claim; but when there are three inventions described, and but two claims made, each of which is valid and for the invention described therein, the court cannot give effect to the third invention, which the patentee has failed to claim.

The developed and improved condition of the patent law, and of the principles which govern the exclusive rights conferred by it, leaves no excuse for ambiguous language or vague descriptions. The public should not be deprived of rights supposed to belong to it without being told what it is that limits these rights.

The interests of the public demand that the claims in a patent should clearly and distinctly define and limit the actual invention claimed by and secured to the patentee.

Mr. Justice MILLER delivered the opinion of the court:

The appellant in this case, who was complainant in the Circuit Court, obtained a patent, in May, 1869, for a new and useful invention, which relates to the heavy hydrocarbon oils, and he sued the appellees, who were defendants in that court, for an infringement of his patent.

The defendants were dealers in oils and not manufacturers of them. If the appellant's patent was for a new oil, the product of a mode of treating the oils of that character which he describes in his application, the defendants may be liable, for they bought and sold, without license or other authority from him, an oil which is proved to be almost if not quite identical with the one which he produced. If, however, appellant's patent is only for the mode of treating these oils invented and described by him—in other words, for his new process of making this new article of hydrocarbon oil—then it is clear the defendants have not infringed the patent, because they never used that process, or any other, for they manufactured none of the oils which they bought and sold.

The counsel for appellant here maintain that his patent is for the new article, and is not for the process, though he describes it fully, by which that article is produced. The appellees insist with equal earnestness that the patent is exclusively for the process by which the new oil is made.

The issue thus presented must be decided solely upon a correct construction of the plaintiff's patent, and the accompanying specifications, in which, as required by the act of Congress, he makes the statement of his invention.

No such question could have arisen if appellant had used language which clearly and distinctly points out what it is that he claims in his invention.

We use the word claim as distinct from description. It must be conceded that the appellant's specification describes with minuteness and precision both the instrumentality and the process by which he makes the oil in question. And in regard to a part of the apparatus which he uses he makes a distinct claim for its invention, and that is not in dispute here. He also describes with fullness and accuracy the process of distillation by which he produces this oil. He gives the temperature to be used, the mode of heating, the degree of rapidity or delay to be used in distilling the introduction, and the advantage of that introduction, of superheated steam into contact with the oils to be distilled during the process.

He also describes, though in short terms, the article produced, the main feature of which he declares to be its freedom from the offensive odor which, before his invention, seemed to be an inseparable quality of those oils; and he mentions some of the more important uses to which this deodorized oil is applicable in the arts.

It is fairly to be inferred from this statement that if all which is described as new in these specifications is really so, the inventor has a right to a patent for three inventions:

1. For a modification or improvement in the distilling apparatus,
2. For a new process or mode of distilling heavy hydrocarbon oils, by which they are deprived of their offensive odors.
3. For the product of this new process of distillation, namely, the deodorized heavy hydrocarbon oils fitted for use in the arts.

When a man supposes he has made an invention, or discovery useful in the arts, and therefore the proper subject of a patent, it is nine times out of ten an improvement on some existing article, process, or machine, and is only useful in connection with it. It is necessary, therefore, for him in his application to the Patent Office to describe that upon which he engrafts his invention, as well as the invention itself, and in cases where the invention is a new combination of old devices he is bound to describe with particularity all these old devices, and then the new mode of combining them, for which he desires a patent. It thus occurs that in every application for a patent the descriptive part is necessarily largely occupied with what is not new, in order to an understanding of what is new.

The act of Congress, therefore, very wisely requires of the applicant a distinct and specific statement of what he claims to be new and to be his invention. In practice, this allegation of the distinct matters for which he claims a patent comes at the close of the schedule or specification, and is often accompanied by a disclaimer of any title to certain matters before described, in order to prevent conflicts with pre-existing patents.

This distinct and formal claim is, therefore, of primary importance in the effort to ascertain precisely what it is that is patented to the appellant in this case.

In this part of his application he makes two separate claims, the second of which relates to a modification of the distilling apparatus, and is not in dispute here. Turning our attention to the first claim, we are compelled to say that the language is far from possessing that precision and clearness of statement with which one who proposes to secure a monopoly at the expense of the public ought to describe the thing which no one but himself can use or enjoy without paying him for the privilege of doing so. It is as follows:

I claim the above described new manufacture of the deodorized heavy hydrocarbon oils suitable for lubricating and other purposes, free from the characteristic odors of hydrocarbon oils, and having a slight smell like fatty oil, from hydrocarbon oils, by treating them substantially as is hereinbefore described.

The word manufacture in this sentence is one which is used with equal propriety to express the process of making an article, or the article so made. "The manufacture of hydrocarbon oils," means primarily the making of hydrocarbon oils. It may mean the thing made also. Are there other words in the sentence calculated to throw light on the meaning of this one?

I claim the above described new manufacture of hydrocarbon oils * * by treating them substantially as hereinbefore described.

It seems to us that the most natural meaning of these words is that—

I claim this new mode of manufacturing hydrocarbon oils by treating them as hereinbefore described.

This is the meaning which would first suggest itself to the mind. If the product is meant, the "by treating them substantially as hereinbefore described" are useless. They are not only useless, but embarrassing, for by the well settled rules of construing all instruments some importance must be attached to them; and if they are to be regarded at all they must either refer to the process of making the oils for which the applicant is claiming a patent, or they are intended to limit his claim for a patent for the product to that product only, when produced by treating the oils in the manner before described.

The counsel for appellant disclaim this latter construction, and allege that the patent covers the oil described, by whatever mode it may be produced. It is necessary to insist on this view, because it is made to appear in the case that the oils sold by defendants were produced by a process very different from that described by appellant.

We can see no reason why the applicant for the patent, if he had in his mind a claim for the article produced, should have intended so to limit his claim. If the *article* was the discovery which he sought the exclusive right to make, use, and sell, he was entitled to that monopoly, however produced.

If, however, he had in his own mind only a claim for the process of manufacture by which the article was made, then his reference to the mode of treating the oils from which it came was evidently proper and intelligible.

But the language in the specifications aids us in construing the claim. In the sentence next preceding this claim he says:

It will also be evident to those skilled in the art that *my invention* will be used, if the above mentioned process be worked, to produce the deodorized heavy oils above described from distilled hydrocarbon oils, etc.

It is very clear that what he here calls his *invention* is a thing which produces the deodorized oils, and not the oil itself. So, again, he says:

From the above it will be obvious that my invention consists *in producing* heavy hydrocarbon oils suitable for lubricating and other purposes, and free from the characteristic odor, *by distilling from them the volatile matter from which objectionable odors arise.*

Again, he says:

In carrying on my new manufacture of deodorizing heavy oils with this apparatus, I place the oil to be deodorized in the still and heat it by the fire beneath to the required temperature to commence the operation, the steam being shut off from the coil, and the outlet cock being opened to admit of the expulsion of any water from within the coil.

Here the word "manufacture" is used in the sense of the word "process," a word which could be substituted for it without a shade of change in the meaning. As it can here mean nothing else but process, we have a definition of the meaning to be attached to it in other parts of the same paper, if that meaning were otherwise doubtful.

But apart from these verbal criticisms, all of which are just, and tend strongly to show what was the invention claimed by appellant, it is impossible to read the four printed pages of specifications in which appellant minutely describes his invention without observing that they are almost wholly directed to the apparatus, the mode of using it, and the peculiar process of distillation, by which the more volatile parts of the heavy oils, which contain the offensive odors, are separated from the main body of the oil, pass over in that process, and leave the remainder free from this great drawback in its use in the arts. Why should this be so if the applicant for the patent was only looking to the products as his invention the deodorized heavy hydrocarbon oils? If the oil alone was to be patented, by whatever process made, this elaborate description of one particular process was unnecessary.

A strong appeal is made by counsel to give the appellant the benefit of a liberal construction in support of the patent. Cases are cited in which this court has held that rather than defeat a patent where it appears that a valuable invention has really been made, this court, giving full effect to all that is found in the application on which the Patent Office acted, will uphold that which was really invented, and which comes within any fair interpretation of the patentee's assertion or claim.

We are not disposed to depart from this rule in the present case. There is no question here but that the patent is good for the second claim, for the superheating coil, with its steam pipe, etc. And we are all of opinion that it is good for the process of distillation described in the specifications, by which the heavy hydrocarbon oils are deodorized. It is, therefore, a valid patent for two important matters well set forth and described. If the patentee is also entitled to a patent for the product of this distillation, and has failed, as we think he has, to obtain it, the law affords him a remedy by a surrender and reissue. When this is done the world will have fair notice of what he claims—of what his patent covers, and must govern themselves accordingly.

The growth of the patent system in the last quarter of a century in this country has reached a stage in its progress where the variety and magnitude of the interests involved require accuracy, precision, and care in the preparation of all the papers on which the patent is founded. It is no longer a scarcely recognized principle struggling for a foothold, but it is an organized system with well settled rules, supporting itself at once by its utility, and by the wealth which it creates and commands. The developed and improved condition of the patent law, and of the principles which govern the exclusive rights conferred by it, leave no excuse for ambiguous language or vague descriptions. The public should not be deprived of rights supposed to belong to it without being clearly told what it is that limits these rights. The genius of the inventor constantly making improvements in existing patents, a process which gives to the patent system its greatest value, should not be restrained by vague and indefinite descriptions of claims in existing patents from the salutary and necessary right of improving on that which has already been invented. It seems to us that nothing can be more just and fair, both to the patentee and to the public, than that the former should understand and correctly describe just what he has invented, and for what he claims a patent.

In consistency with these views, we are of opinion that the appellant in this case has described and claimed a patent for the process of deodorizing the heavy hydrocarbon oils, and that he has not claimed as his invention the product of that process.

The judgment of the Circuit Court is affirmed.

Mr. Justice Clifford dissenting.

I dissent from the opinion and judgment in this case upon the ground that the invention, when the claim is properly construed, is an invention of the described new manufacture, and not merely for the process as decided by a majority of the court.

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 MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PISTON.

Robert M. Beck, Westminster, Md.—This invention is an improvement in steam pistons, and it consists in combining an expansible ring with two disks having beveled edges, which expansible ring is made continuous and entire without split or joint from a composition of metals, and when the beveled disks are adjusted together by means of a screw nut, is by reason of its soft character swayed or expanded so as to increase the diameter of the piston and compensate for wear, and which disks are provided respectively with a bar and a recess to guide the parts, and have between the same washers to limit the adjustment.

IMPROVED BREECH-LOADING FIREARM.

Victor Bovy, New York city.—This invention is to provide an improved breech-loading shotgun, in which the barrels may be readily removed from the breech piece and the different parts of the mechanism be taken apart and put together with great facility, without the use of screws, and without requiring tools to disconnect or replace the parts, which gun may be readily repaired and any injury ascertained. The invention consists of a breech-loading shotgun, operated by a lever that throws a bolt and locks thereby the hinged barrels to the breech piece, pushing the center firing pins backward on releasing the bolt. A fixed elbow piece of the frame operates the extractor and serves in connection with a recessed lug of the barrels to attach firmly the detachable forestock in position.

IMPROVED CAR BRAKE.

Edward Spencer Jones, Pulaski, Tenn.—This improved brake, for railroad cars of all kinds, may be operated by hand or steam power, so as to check the speed and stop the train in a quick and reliable manner; and the invention consists of brake shoes which are applied by pivoted lever arms to a crosspiece that is raised or lowered by a screw bolt and nut and suitable gearing, either by an endless chain connection with the locomotive, or by shaft and gear connection with a hand wheel at end of car. A suitable lever arrangement throws the brake mechanism either into gear with the handwheel or with the gear worked from the locomotive.

IMPROVED TOBACCO-HOISTING APPARATUS.

Clifton H. Slaton, Slaughterville, Ky.—The object of this device is to hoist tobacco up in a barn, and also to take it down, with great facility, the apparatus being worked by one man that stands on the floor and hoists, while another brings the tobacco from the wagon and places it on the hoister, they saving thus the work of other hands, and attending to the hoistering or lowering without climbing up and down in the barn. It consists of a top crossbar supported upon the top beams of the barn, and having a jointed upright suspended therefrom, with a crosspiece having hooks for supporting the stick of tobacco. The crosspiece is attached to a sliding box or carriage and hoisted by a rope applied thereto and passing over a top and bottom pulley of the upright.

IMPROVED BEARING AND BOX FOR VERTICAL SHAFT.

Levi Webber, North Vassalborough, Me.—This is an improved bearing and box for the shafts of waterwheels and other vertical shafts that support great weights, to prevent the steps from wearing or burning out so quickly. It consists in the combination of the box, made in two parts bolted together, provided with the lugs or flanges, the inner rim, the chambers to receive Babbitt metal, the outer rim, the oil chamber, and the oil channels, and the bearing, made in two parts, bolted together, and provided with set screws and a countersink, with each other, to adapt them to be connected with a vertical shaft to support its weight.

IMPROVED TRIGGER FOR FIREARMS.

Max Heuser, New York city, assignor to himself, Emil Welte, and Carlo Otto, Jr.—This invention consists in the combination, with a trigger, of a wheel, having arranged on its periphery oppositely arranged cam lugs and a tripping arm that is pivoted in the trigger, and carries two spring tappets that are engaged by the cam lugs of the wheel, so as to shift the tripping arm from one dog of the gunlock to the other as the trigger is worked. The trigger is provided with the usual spring for returning it to its normal position after it is pulled, and the device is connected with an ordinary double lock of a double barreled gun. By changing the relation of the cam lugs, the same device may be applied to guns having three or more barrels, or to revolvers or pistols.

IMPROVED NUT LOCK.

Samuel Caldwell, Greenfield, O.—In this invention, the head of a fastening bolt is recessed at one or more sides, and is provided with a washer having one or more upturned flanges as well as the nut. The washers are turned up at one or more sides, and extended over the top and bottom of the fishplate, so as to be tightly retained between the same and the head and base of the rail. The washers may also be extended back of the fishplate and turned over in front of the same, bearing on opposite sides of the nut, or the washer may be extended downward under the base of the rail, to produce the rigid position of the washer, and impart a double support or rest to the bolt and nut, which enables them to resist more effectually the vibration of the rails without any chance for friction and wear by turning or of getting loose.

IMPROVED EXPANDING ROCK DRILL.

Wellington R. Burt, East Saginaw, Mich.—This is an improved tool or drill for the purpose of enlarging the lower part of salt, oil, and artesian wells without enlarging the top of the same; and it consists of hinged and wedge-shaped expanding arms that are spread or closed by a wedge-shaped slide piece and operating screw shaft passing through the same, and turning in the head of socket of the expanding arms. By moving the wedge piece down, the arms are spread outwardly, so as to pass against the surrounding walls of the well and expand the same to some extent, obtaining thereby a larger sized hole than at the upper part of the well. By turning the screw shaft in opposite directions, the wedge piece is moved up and the arms are brought closer to each other, to be drawn up again through the bore hole.

IMPROVED WEIGHT MOTOR.

John M. Cayce, Franklin, Tenn.—The general principle of this invention rests in the transfer of a weight from one side of a pivoted frame to the other, and the utilization of the consequent rocking movement of the frame to communicate a rotary motion to a flywheel through a ratchet and pawl mechanism. The improvement consists mainly in arranging two weighted levers in a frame and gearing their inner ends together by cogwheels, so that when the two weights are to be transferred from one side of the pivoted frame to the other, they move in opposite directions and describe upper and lower semicircles. The merit of this arrangement is that while the two weights co-operate with each other and impart to the frame their aggregate motive value for the given portion of their effective stroke, they also counterbalance each other while being shifted from one side to the other of the pivoted frame, so that a much less power is required to effect said transfer than is represented by the actual weight of the levers.

IMPROVED SAND PUMP.

William H. Birge, Franklin, Pa.—This invention consists in the arrangement of a sliding valve in the lower end of a sand pump, which is opened by the weight of the pump and closed by a spring. It also consists in the arrangement of an air valve in the top of the sand pump, which is closed by the water through which it passes, which acts on the fan-shaped end of the valve lever, and is opened by the weight of the fan-shaped end of the lever, and by the upward pressure of air created by the entrance of water in the sand pump. The object is to provide a valve which will open and close with a positive motion, not depending on the action of the water or sand.

IMPROVED WIRE SCREW AND NUT.

John T. Bruen, Brooklyn, N. Y.—To make the screw, two, three, or any number of wires desired are taken, and, by means of suitable tools, twisted together, so as to form a screw of even pitch, and the wires are fastened together at their ends by means of solder or otherwise. They may also be soldered together throughout their entire length, if desired. To form a nut for the screw just described, a thimble or section of pipe that will fit loosely over the screw is taken, and in it are formed slots corresponding in number and direction with the grooves between the wires of the screw, and in these slots are placed wires which extend through the sides of the thimble, which may be either straight or slightly curved, and set the metal of the thimble down around the wire to hold it firm in its slot, allowing it to project inwardly sufficiently to engage the threads of the screw.

NEW TEXTILE INVENTIONS.

IMPROVED LOOM TEMPLE.

James E. Waterbury, of Rensselaerville, N. Y.—This invention consists of a temple for weaving tubular goods, which is held in its position in the tube by means of rollers that act through the substance of the tube in supporting and moving it. The object of the invention is to prevent the contraction of the tube by drawing the filling, and also to prevent hard longitudinal streaks in the goods.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED BENCH PLANE.

Watson Wood, Chelsea, Mass.—This invention has reference to an oiling attachment to iron or iron-faced planes, by which the objectionable sticking or friction of the same on wood is obviated; and it consists of an iron or iron-faced plane, having an oil receptacle and feed device in front of the cutting iron. A small hole is drilled through the face of the plane in front of the cutting iron and in the center of the face. This hole is connected either by a small tube or directly with an oil receptacle that may be either cast on the plane inside of the knob, which is generally used as a handle, or otherwise attached to the same. The oil receptacle is closed by a knob that is secured or otherwise applied in an airtight manner thereto. A wick or piece of soft leather is arranged at the inside of the receptacle and in the feed hole, so as to prevent the oil from being fed too fast on the face of the plane. The wick or other device admits only the escape of a quantity of oil sufficient to allow the iron-faced plane to run smoothly and easily over the wood, giving the iron face sufficient lubrication to destroy the friction or sticking of the same on the wood without greasing the work or the hands of the person using the plane.

IMPROVED CAR STARTER.

John Marsden, Chester, Pa.—This invention is designed chiefly for horse-cars. Doubletrees are hitched to the drawbar in the usual way, and when the car stops the drawbar is drawn in by the action of a spring—link, pawl, and levers moving back with it. A shoulder on the pawl strikes a knee and throws it up out of the notches of the ratchet wheels, so that the pawl offers no impediment to the motion of the car in either direction. When the horses start, the first outward motion of the drawbar releases the pawl from the knee, when it drops into a notch in the ratchet wheel, and the further drawing of the horses results in starting the car by turning the axle and wheels. This action continues until the head on the drawbar formed by the joint strikes the guide, when the further pulling of the horses draws the car ahead in the usual way.

IMPROVED WAGON BRAKE.

James M. O'Neall, Fort Worth, Texas.—This brake is designed to be attached to the under side of a buggy or wagon body, in such manner that it may be operated by the foot of the driver applied to the bent arm of a lever projecting up through a slot in the bed or floor. The said lever has a sector-shaped toothed portion which meshes with a toothed sliding rack bar that is immediately connected with and operates the brake levers proper.

IMPROVED WHIP SOCKET.

James Lowth, Chicago, Ill.—This invention relates to an improvement in that class of whip sockets which are provided with a hinged jaw for clamping a whip. The novelty consists in making the hinged front jaw with a rigid extension, and providing the latter with a perforated lug, through which the bow of a padlock is passed to lock the jaw and secure the whip in the socket. The invention further consists in slotting the back of socket to provide for the operation of the hinged jaw and its rigid extension.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SORGHUM MILL.

Edward A. Withers, Marietta, Ga.—This improvement pertains to the construction of the frame of the mill, and the manner of connecting the crushing rolls therewith, the object being to effect the utmost economy in dimensions, weight, and cost of the frame, and to enable the rollers to be adjusted, applied, and removed with the greatest facility.

IMPROVED HARROW.

Samuel J. Franklin, Fair Mount, Ga.—This invention consists in the peculiar construction and arrangement of teeth in a frame to form a harrow, the said teeth being made in the form of blades with a hooked upper end, which blades fit into slits in the frame, and when deflected to an angle of about 45° are securely held in said frame by means of their hooks, without the use of pin, screws, bolts, keys, or other devices for securing them.

IMPROVED CORN PLANTER.

John O. Bennett, Urbana, O.—In this machine the seed cut-off brush is held and adjusted vertically by a peculiar device; the discharge of seed from the spouts is controlled by centrally pivoted vibrating plates operating as valves, and connected in pairs by means of a rod; the foot of the seed spouts is so shaped and so connected with a curved runner, or sod cutter, which goes in advance, that it will lift and pulverize the soil better than the ordinary form of furrow opener.

IMPROVED PLOW COLTER.

Charles R. Thompson, Lebanon, Ky.—The object of this invention is to furnish colters which shall be so constructed as to cut the sod into narrow strips, separate it from the soil beneath it, and leave it in its place, so that it will be turned under with the furrow slice. It consists in the combination of two or more colters, provided with horizontal triangular cutters at their lower ends with the same beam.

IMPROVED FENCE.

Robert F. Ward, Senatobia, Miss.—The object of this invention is to improve the construction of the fence for which letters patent No. 143,473 were granted to the same inventor October 7, 1873, so as to secure the rails in place more firmly, keep them from being moved upward, and give additional support and strength to the fence. It consists in the notches or shoulders formed in the lower edges of the inclined strips to receive the upper edges of the filling rails, to keep the said rails in place, and in the upright strips attached to the inclined strips at the outer side of the filling rails.

IMPROVED FENCE.

Robert F. Ward, Senatobia, Miss.—This is a straight braced fence, so constructed that it can be laid rapidly and with a great saving of lumber over the old crooked fence, and so that it will stand erect and steady against strong currents of wind and water, and against unruly stock, and which is not liable to be disarranged. It consists in the combination of the filling-in rails having their ends laid upon the opposite sides of the adjacent posts, and overlapping each other, and the stakes driven into the ground at the opposite sides of the ends of the filling-in rails from the posts, and having their upper ends nailed to the inclined braces with the posts, the lower riders, the inclined braces, and the upper riders.

IMPROVED MACHINE FOR PRESSING CORNSTALKS, ETC., FOR FUEL.

Edgar P. Davis, James E. Davis, and John J. Fisk, Crete, Neb.—This is an improved machine for pressing cornstalks, hay, weeds, and other light material into bundles for fuel, which enables the material to be easily and quickly pressed into compact bundles. When the material has been compressed, bands are fastened around it in such positions as to be in the centers of the lengths or sections when sawed apart. The bands are each formed of two pieces of wire jointed to each other at one end, and having hooks and eyes formed upon them at the other ends—several eyes being formed in the said wires so that the same band may be used for binding different sized bundles. The eyes are formed in the band by forming small coils in the wire.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DESK.

James R. Richardson, Majority Point, Ill.—This invention consists in the arrangement of movable sections in the top of the desk, which are raised or lowered by means of racks and toothed sectors, to accommodate the desk to books of different thickness, and to adjust it to different heights to suit different persons. Movable portions of the top of the desk are guided in slots at the sides of the opening in which they are placed. Racks are attached centrally to the movable portions of the desk top, and are guided by crossbars that extend across the under portion of the desk top. Toothed sectors mesh into the racks, and are secured to the inner ends of shafts which are journaled in the end rails of the desk, and in hangers that are attached to the crossbars. To the ends of the shafts cranks are attached carrying lock levers that engage the notched plates at the ends of the desk. By disengaging the lock levers and moving the cranks, parts of the desk top may be adjusted so as to accommodate the covers of a book that is opened at one side of its center. The two sides of the book thus supported present a level surface, which may be upon the same plane as the top of the desk, or above it, as circumstances may require.

IMPROVED VEGETABLE SLICER AND GRATER.

John P. Dunwald, New York city.—By this invention potatoes, beets, radishes, and other vegetables may be sliced in rapid manner, and horseradish, nutmegs, and other articles may be grated with facility. It consists of a feed hopper and follower arranged in connection with a horizontally revolving tubular slicer or grater, composed of a detachable head, body, and interior clamping ring plate.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED GAME AND CARTRIDGE BELT.

Andrew A. Case and Elwin W. Bedell, Chetopah, Kan.—This consists of a belt hung from the shoulders by suitable straps and encircling the waist, and provided with hooks for carrying game, and with a flap having pockets for carrying cartridges.

IMPROVED FOLDING CRATE.

Gilbert Robinson, Jr., New York city.—The object of this invention is to furnish packing boxes so constructed as to be conveniently taken apart and packed together in small compass for reshipment, so as to save to the shipper the cost of making new boxes every time he has to ship goods. It consists in an improved packing box formed by the combination of top and bottom boards, side boards, end boards, angular strips, spring catches, strap hooks, and lugs.

IMPROVED METALLIC SEAL.

Frank A. Ferris, New York city.—This invention consists of two semi-sections or shells of corresponding shape, having recesses for the strings on the inner sides, facing each other, and being attached by studs of one section passing through perforations of the other section, which studs are then spread or flattened to connect the sections. The semisections or shells, of round, oval, or any other suitable shape, are cast, pressed, or stamped of lead or any other metal. They are provided with recesses for the strings at their inner sides, the exterior sides being, one or both, cast or stamped with the name of the firm, corporation, or person employing the seal. The shells may be made with extension lugs or ears, of which those of one shell carry studs or pins that pass through corresponding holes of the ears of the other shell. The studs and perforations may, however, be arranged in the body of the sections near the circumference, but at diametrically opposite points, and at right angles, or nearly so, to the direction of the strings to which the seals are applied. When the seals are to be fastened to the strings, the sections are to be placed at both sides of the same, so that the strings are seated in the recesses of the shells, the studs of one section being passed through the perforations of the other sections, and then compressed, by pinchers or other suitable implements, so that the ends of the studs spread and bind tightly on the perforated section. The seal sections are thus united in an instant in a very convenient manner, and are attached tightly to each other, and either tightly or loosely to the strings, as required.

IMPROVED STOPPER ATTACHMENT.

Barnard Arnold, Foster Centre, R. I.—This invention consists in making from wire a screw or spiral terminating at one end in a point and at the other end in a ring, and is screwed into the stopper and attached to an elastic band which surrounds the neck, the object being to provide a device by means of which the stopper may readily be extracted, and by which it is supported when out of the bottle, so that it does not come into contact with the bottle, and is not liable to become lost.

IMPROVED LETTER FILES.

Paren England, Lincoln, Neb.—This invention consists, first, in the particular arrangement of a clasp with respect to the backs of the file, which clasp is made in the form of the lazy-tongs, and is adjusted by means of a thumb screw that causes the bars of the lazy-tongs to be held rigidly together and at the same time forms a pivot for said bars. The second feature of the invention consists in giving to the hinged or back portion of the file an expansibility to correspond to the adjustment of the clasp, which is effected by means of metal tubes and an elastic spring arranged in the said tubes and passing through the indexed pages of the file.

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.

Wanted—A first-class Machine forger. One who is a good performer on any instrument in Brass Band. References required. Address H. B. Smith, Smithville, Burl. Co., N. J.

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To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

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Notes & Queries

F. B. N., who asks about the carpet-eating bug, see p. 307, vol. 35.—C. A. D. will find the answer to his query in any work on Natural Philosophy.—P. H. R. had better consult his family physician.—C. H. McK. will find full information about suction pumps in No. 20, first series of "Practical Mechanism."—A. K. Q. can ascertain how high the water will rise by survey. He does not state how much fall there is in the distance he mentions.—T. M. is informed that he will find the description and cut of the electric candle in vol. 36, No. 22. The candles are not made in this country.—O. H. Y. had better correspond with makers of band saw machinery.—Novice, London, Canada.—You can lay your tiles upon a floor of cement.—J. V. C. and H. B. are referred to "Smee's Electro Metallurgy."—J. H. S.—We know nothing of the instrument you mention.—J. L. G. is referred to his family physician.—W. H. P. had better insert a notice in the "Business and Personal" column for information concerning the market for mohair.—M. M. M. does not tell us how large a cylinder he wishes to cast. If small, brass or Babbitt metal would answer.—P. C. is informed that his article is too vague for publication.—Chemist is informed that we know nothing of the compound mentioned.—J. S.—You are probably correct. The tree protects the building from being struck by lightning.—J. V. E.—The powder you refer to is not yet manufactured in this country.

(1) W. G. S. says: I have among my photo-chemicals a bottle with the mark *Essence Grasse*. Can you tell me what it is, and what it is used for? A. We do not know of any reagent so called. The title refers to a thick, fatty oil or liquid.

(2) J. E. is informed that the vacuo method of filtration is entirely feasible; but where large bodies of water are to be filtered, as for the supply of cities, it has the objection of being very expensive, from the extra steam power required and the necessity of frequently changing the filtering materials. Besides this, water thus filtered is rendered unpalatable and unfit for immediate use by the removal of much of its dissolved gases, etc. For these reasons preference is generally given to the system of reservoirs, wherein the water is allowed to remain quiescent for a sufficient length of time to deposit most of the matter held in suspension, and admit of the more complete oxidation of such organic matter as it may contain by contact with the air.

(3) B. S. asks: Should boilers used only for heating be left with water in them during warm weather? A. No; the water should be drawn off in the spring.

(4) J. F. D. asks: Please give me a recipe for making a colored lime-wash, to be used as a substitute for paint for the exterior of a frame building. The color required is brown. A. Add to the lime-wash a strong solution of sulphate of magnesia, and color to suit with Vandyke brown.

(5) N. K. says: A favorite dog has put our family into possession of (in both senses) ten millions (estimated) of fleas. The dog has been given to a friend (with due warning, of course), but the dog's late companions are still with us in scarcely diminished numbers. Will you please say how we can best succeed in obtaining their room instead of their company. The dog was kept generally in the cellar, and the coal heap especially has "millions in it." A. Soap water; carbolic acid in dilute alcoholic solution; flowers of sulphur either used as a powder or mixed by agitation with water containing a little glycerin; dilute solutions of sulphate of magnesia—any powder or solution containing tannin, as dried sumac, tea, and Persian insect powder. These are the least objectionable exterminators. A little of the carbolic solution may be mixed in with the soap water, and this used as a wash, or sprinkled in infested localities. Flowers of sulphur contain sulphurous acid, which is fatal to the insect, but it must not be used on or near colored woolen fabrics, as it is liable to injure the colors. Sulphate of magnesia solution (in water) may be used as a wash. Sumac powder, etc., give excellent results. The sulphur mixture mentioned, or carbolic acid shaken up with about 20 parts of water, and sprinkled in the cellar, will soon depopulate the coal heap.

(6) An apprentice asks for the best method of laying tile pavement? A. If you have reference to tile laying upon floors, it is done by cutting in boards between the floor joists, and supporting them upon cleats nailed to the sides of the joists. A pavement of bricks in mortar is then laid upon the boards, finishing flush with the top of the joists. A bed of rich cement mortar is then spread over the whole, and the tiles carefully set in a thin grout upon the cement bed.

(7) D. W. Van B. asks: Can you inform me as to the time when the first movable steam fire engine was used? It is stated that a machine was used in Europe in 1851, and was used to supply hand engines. It was taken to the river and water forced through hose to the hand machines. Were steam engines used in this country prior to that time? A. Captain Ericcson built a steam fire engine at Braithwait shops about the year 1836.

(8) H. D. S. asks: Will a solution of chloride of zinc and sulphate of nickel, used for nickel plating iron and steel, serve for nickel plating brass or zinc. The process was described on p. 408, vol. 36. A. Not very well, unless the article is in contact with pieces of zinc, or, what is better, zinc powder, also immersed in the solution. Small pieces of brass work can be plated in this way.

(9) C. E. asks: How can I imitate silver gray in water colors? A. White tempered with a mixture of black and blue is commonly employed. Use flake white, ivory black, and Prussian blue.

(10) K. F. says: We use on our two horse cultivators a plow or plate that seems to be made of iron with a thin plate of steel welded or laid on the front, and made very hard. Our blacksmiths have difficulty in sharpening them. They sometimes crack when heating, and sometimes fly to pieces when put in the water after sharpening. Can you tell us how to manage them? A. Heat them to a low red heat, dip in water at 100° temperature and containing 1 lb. salt per gallon; dip edgeways, and hold quite still at the bottom of the water until cold. A depth of two inches of oil floating on the water would perhaps assist you.

(11) J. D. E. says: 1. I am making a plate electric machine, and have the plate already cut out. Do the edges need to be ground smooth? A. It is better to have them rounded. 2. Of what material should the rubbers for exciting the plate be made of? A. See (No. 9) p. 171, vol. 35. 3. Can you mention a good and short method for drilling a hole through plate glass? A. See Ans. No. 5, p. 186, vol. 36.

(12) D. M. F. says: I am using a small cast iron tank to contain kerosene. It has been japanned, but the oil works its way through the iron, notwithstanding the japan. Can you tell me what will stop this? A. Try a sizing of glue in acetic acid.

(13) H. L. L. says: I desire a cheap shelter for say 250 to 300 tons of hay or straw, and I wish to construct it at once. A. The usual graduated roof shelter will answer the purpose. This consists of a roof of thatch or shingles, pyramidal, on a strong frame, supported at each corner on stout pins, passed through holes in timber posts set well into the ground. The roof may be about 15 feet square, and the posts 20 feet high—these latter may have lateral braces or ties, extending diagonally across the square at the bottom. As the hay is removed from the top of the stack, the roof is lowered down and the pins shifted into lower holes, thus always affording a close shelter to the hay.

(14) S. H. asks: Is there any radiator or heater (steam) made which operates without the removal of the air from its interior? A. We do not know of any. It is essential to the success of a radiator that the dead air within it be displaced either by steam or water.

(15) J. A. B. asks: Can you give me a recipe for a cement to mend a broken marble slab? A. Take gum arabic 1 lb., make into a thick mucilage, add to it plaster of Paris 1½ lb., sifted quicklime 5 ozs. Mix well. Heat the marble and apply the mixture. You had better put supports under the slab.

(16) T. F. P. says: I have samples of the enamel which are used in enameling. How can I use them? A. Mix together equal parts of oxide of manganese, oxide of copper, and oxide of cobalt. Use a soft glass, and fuse enough of the mixture into it to give the desired depth of color; then grind this to a fine powder, and apply with water as a paste; after which dry and fuse. For white, fuse with the glass oxide of tin and antimony, as before. Alumina and oxide of lead may also be used.

(17) J. G. A. asks: Can you tell me where the difficulty is in launching a boat off a vessel at sea, and did the United States Government adopt any apparatus when they had the trial about two years ago? A. The difficulty lies in detaching the boat to keep it clear of the tackle when it strikes the water, for if one end detaches before the other, it is apt to swing from the detained end and turn over. We do not think that any boat detaching apparatus has been exclusively adopted by the United States Government, though several have been reported upon.

(18) E. E. L. asks: Is there anything that can be used in place of muriatic acid for soldering iron with soft solder? A. Sal ammoniac will answer.

(19) W. A. B. says: I recently saw a statement that the relative traction of a belt on a wooden or iron pulley was as 47 to 24. Now, is this a fact? Will a wooden pulley do twice the work of an iron one? If so, why? A. There is a difference in favor of wooden pulleys, but cannot state its amount.

(20) R. K. asks: 1. Can you give me a mixture of something that will stick a piece of lead in the centers of locomotive driving axles without burring them with a chisel, as doing so injures the centers. A. The lead will stick in of itself when well hammered in. 2. Is there any rule to get the throw of locomotive eccentrics, or can I find it in any book? A. See "Auchincloss" on the slide valve.

(21) W. T. asks: I would like to know what makes steel crack in hardening? A. Improper heating or dipping and taking the article out of the water too soon are the principal causes. Sometimes the steel is improperly forged, or overheated in forging. Much also depends on the shape of the article when finished.

(22) H. F. H. asks: What is the best preparation to put on a greenhouse floor of wood, so as to render it impervious to moisture and prevent it from warping and cracking? Also what is the preparation to paint hot water pipes in a greenhouse to prevent rust? A. Cover your floor with a thin layer of hydraulic lime or cement. Paint your pipes with a covering of asphaltum varnish, made by dissolving asphaltum in turpentine by a gentle heat.

(23) E. H. L. says: I am making a safe to keep valuable papers in, and wish to put in a filling that will make it fireproof. What is the best preparation for that purpose? A. The preparation usually employed for filling safes is calcined plaster of Paris mixed with water to the consistency of thick cream, and allowed to harden. It would be advisable to coat the surface that would come in contact with the wet filling with the asphaltum varnish recommended to H. F. H. This will prevent rusting the iron plates of the safe.

(24) F. M. says: Tobacco stalks or stems, as stripped from leaf tobacco by cigar makers, can be had very cheap in Cuba. Is there not some use or application for them, chemically or otherwise, beside the manufacture of snuff? A. We know of no extended use for such product.

(25) W. G. F. says: Please tell me how to braze with brass and use hard and silver solder with blowpipe? A. To braze with hard or silver solder, file the metal clean and smooth where the intended union is to be, bring them in close contact, apply the solder in small pieces and fuse, using borax as a flux. 2. How can I restore temper to spring steel when once drawn or heated? A. To restore the temper of steel, it must be hardened and then drawn to the requisite spring temper.

(26) D. L. asks: Can I ignite gunpowder by using a galvanic battery? A. If a fine platinum wire be interposed between the wires that are connected with the poles of the battery, it will be heated sufficient to ignite gunpowder.

(27) W. R. asks: How can I make a good branding ink for branding bagging—such as is used for baleing cotton? I have been using an ink made from lampblack and kerosene, but this blurs very badly and gives our bagging a dirty appearance. A. Try common boot blacking. Dampen your brush with water to use it. If there is acid in the blacking it will eventually injure your brass stencil plates.

(28) O. P., of Kosloff, Russia, asks: How can I color polished steel a dark blue? A. See reply to B. T., in this number.

(29) W. T., of Montreal, is informed that the address of the publishers of the work on Gravestones is A. T. Bickwell & Co., 27 Warren street, New York city.

(30) W. H. C. says: Perhaps the following mode of fluting reamers, cutters, taps, etc., may be new and useful to some mechanics, especially those that possess a lathe with slide rest. I leave a work to be fluted in lathe centers, and with tool of the desired shape of flute fastened in the tool post, work the slide rest back and forth, feeding the tool in to the required depth. Mine is a back geared screw cutting lathe, and I have very satisfactorily and with dispatch fluted reamers, etc. A snap catch fitting tooth of back gear holds the work while cutting. The gear also acts as index wheels which can be divided into 4ths, 8ths, 10ths, 16ths, etc. The heads of lathes that are not back geared can easily be divided up for all ordinary work.

(31) C. F. makes inquiry about seasoning lumber, and is answered that the most successful builders, piano manufacturers, etc., generally season their lumber in the natural way, by stacking it in their yards for two years or more, which in the majority of instances is the most satisfactory in the end. There are cases where water soaking is adopted to drive out the sap. The logs are left in the water for six months, then taken out and sawed into boards, and the latter stacked up to dry. In this case, it is claimed, the water rapidly dries out and takes the sap with it.

(32) F. M. says: Can you give me any cheap method for renovating tarnished gilt frames? Any color or material will do, provided it is simple and cheap. A. The cheapest is to cover the surface to be gilded with oil size thinned with spirits of turpentine. Gold, in powder, is then gently dabbed in with a little pod of soft leather. The work can be varnished.

(33) C. E. L. asks: What can I mix with asbestos that will make it as pliable as leather after it is pressed in any form? A. Try mixing it with rubber and then vulcanize.

(34) F. L. asks: Can you inform me how to tin small cast iron articles? A. Immerse the articles in a bath of sulphuric acid for a time sufficient to obtain a bright surface, then dip in muriate of zinc, remove and plunge in a bath of melted tin.

(35) J. R. asks: What is the number of locomotives built in the United States that have been shipped to Russia? A. We cannot ascertain.

(36) J. Y. asks: Please give me a recipe for making a good black ink that will copy? A. Add sugar 1 oz. to 1¼ pint of good common writing ink.

(37) J. K.—A brass founder will give you the information relative to gongs. Oil can be colored by putting alkanet root into it.

(38) J. B. asks: What can I use to keep patterns from sticking in plaster of Paris moulds? A. If the patterns are so made that they have a sufficient draught, coat them with thin shellac varnish.

(39) H. Y. C. asks: Where do the oyster and other shellfish get the lime from which to make their shells? A. The lime salts are held in solution in the water, and derived from it by the animals.

(40) H. K. asks: Can you give me a recipe for straightening amber mouthpieces? A. Heated oil will soften amber and make it pliable. To melt it requires a heat of 517° Fah.

(41) W. E. T. says: Having seen a notice of Professor F. Sacc's (Neufchatel, Switzerland) process for curing meat by submitting it to the action of acetate of soda, I should like to know the *modus operandi*. A. The mode of operation is very simple. Arrange the meat in a barrel, deposit about and on it powdered acetate of soda to about the quarter of the weight of the meat. In summer the action takes place immediately; in winter it is necessary to place the vessels in a room warmed to about 68° Fah. The salt absorbs the water of the meat; after 24 hours the pieces are turned, and the lower placed uppermost. In 48 hours the action is finished, and the pieces are packed in barrels with their brine, or dry in the air. If the barrels are not full, it suffices to fill up with the brine made by dissolving one part (by weight) of the acetate of soda in 3 parts of water. The pieces may be of ordinary size, and when required for use may be freed from the salt by washing in running water. The dry acetate of soda may be recovered from the brine by evaporating off the water over a fire.

(42) G. M. C. asks: How can I color buck and goat skins black? A. Soft water, 5 gallons; bring to a boil, and add 8 ozs. of logwood extract, pulverized; boil three minutes, remove from the fire, and stir in 2½ ozs. gum arabic, 1 oz. bichromate of potash, and 80 grains of prussiate of potash.

(43) H. C. asks: Please give me directions for polishing shells? A. The outer skin of sea shells can be removed by washing with a rag dipped in hydrochloric acid, then wash in warm water, and polish with rottenstone or fine tripoli powder, applied with a little oil on a bit of soft rag. Where there is opportunity to do so, rub with lump pumicestone moistened with water, and finish as above.

(44) D. C. R. is informed that he can paint his smokestack with coal tar or asphaltum varnish. The varnish can be made by dissolving the asphaltum in turpentine with a gentle heat. Apply with a brush.

(45) J. D. P. & Co. say: We have a six inch belt which we gave two or three coats of lard oil, and now cannot use it because it slips on the pulleys. A. Wash your belt with a weak alkali or soda water, and then in clean water. Let it dry thoroughly before put-

ting on the pulleys. Some mechanics apply oil and powdered resin to belts to make them hug the pulleys, but the process is not cleanly nor beneficial to the belt. Dry powdered resin might do, but clean belts, tightened sufficiently to hold to their duty, are preferred by good workmen.

(46) B. T. says: Please give me a composition to put on pistol barrels to make them dark blue. A. No composition is used. The barrels are first nicely polished and then burnished. The work is then immersed in powdered charcoal, wood ashes, or even fine sand, heated over a fire. Keep the work equally heated, and after a sufficient time the required color will be obtained, when the work must be removed from the heating material. It would be advisable to send such work to some manufactory of firearms, where experts are employed.

(47) F. A. R. asks: Can you give me a simple way of making ice? A. See p. 82, vol. 33, for a description of Carré's freezing apparatus. The principle therein embodied is simple. It would probably meet your wants.

(48) T. A. informs M. A. that by dissolving 1 oz. cyanide of potassium in 1 quart of soft water he will have a dip in which he can wash his spoons and instantly remove the sulphide of silver. The solution must be kept in a bottle that is tightly corked and labeled poison.

(49) W. S. L. says, in reply to T. McC., who asked if there is any liquid that will dissolve glue without the application of heat or water, that whisky or alcohol will do this; and on the evaporation of the whisky the glue will become exceedingly hard.

(50) W. D. P. informs M. H. H. that he can make a good wash for brick walls of water lime or cement and skimmed milk, and says it will be good for ten years.

(51) A. E. S. is informed that hats are sized with lac solution and stiffened with a thin size of glue. For rubber cement see back numbers of the SCIENTIFIC AMERICAN.

(52) C. H. B. says: How can I etch on brass, and how can I join a brass tube, as I do not want to soft solder it? A. Dilute nitric acid may be used for etching on brass. The etched surface will not be of brass but of copper, as the zinc dissolves much more rapidly than the copper, and to some extent, by galvanic action, protects the latter. This cannot be avoided. To join the tube, braze it with spelter solder, using borax as a flux.

(53) J. R. B. says: I want a recipe for making a good lacquer for brass? A. Use shellac varnish tinged with saffron, annotto, or aloes, and apply with a brush to the work, which has been previously warmed. This will give a golden color to the metal.

(54) E. C. H. is informed that he will find an exhaustive article on cone pulleys in "Wrinkles and Recipes," p. 128. Exposing the saw to the heat of the sun will not cause the saw to lose its temper. In casting the Babbitt metal the trouble probably lies in there being no vent, and the confined air caused the imperfect filling. Drill a small hole in the upper portion of the box, so as to let out the confined air.

(55) P. R. says: Please give directions for plating small brass articles with either silver or nickel without a battery. A. A cheap method of silvering is to mix 1 part of chloride of silver with 3 parts pearlash, 1½ common salt and 1 part whiting. Clean the articles well and apply the plating mixture by rubbing it with a cork or a roll of soft leather. When silvered, wash thoroughly and wipe dry. For information about nickel plating without a battery see directions for so doing at end of article on "Nickel," in *Appleton's American Cyclopedia*.

(56) J. W. S. asks: Can you tell me how I can take a duplicate, in type metal, of bookbinders' hand stamps, also of embossing stamps? A. You can produce copies of the stamps by casting or stereotyping in plaster moulds. It would be better to obtain them by the electrotype process. Various cyclopedias will give you information of the first, and you can obtain books devoted to the second process.

(57) H. J. B. asks: What preparation can I use to reprime rim-fire cartridge shells that have been used once, so they may be loaded again? A. Perhaps the composition used for percussion caps will be best adapted to your purpose, which is fulminate of mercury mixed with half its weight of niter. After the fulminate is inserted in the shell, cover it with a film of thin shellac varnish.

(58) J. B. J. asks if phosphor bronze will bear the explosive force of gunpowder equally as well as decarbonized steel, etc., and is referred to Nos. 45 and 48 of the SCIENTIFIC AMERICAN SUPPLEMENT, where he will obtain the desired information.

(59) J. G. M.—You are probably correct in regard to your idea of the fruit you mention.

(60) W. H. B., London, Canada, is informed that if he will address a letter to the institute he will receive circulars that will give him all information.

(61) O. H. N. informs A. J. that he has an invention for throwing a paddle wheel off its center.

(62) D. R. is informed that the largest shipments of canary birds are made from Germany. He may correspond with Louis Ruhe, 98 Chatham street, New York city.

(63) A. A. B. is informed that the oriole is a very difficult bird to rear in confinement. Inexperience in management and improper food was the cause of the death of the birds.

(64) C. G. H. asks: What will remove the stain of nitric acid from black wooled goods? A. Wash with a strong, hot solution (in water) of carbonate of alumina. If this does not remove the stain it may be concluded that the acid has destroyed the coloring matter—this is usually the case. If the yellow stain remains, the only remedy will be to re-dye the material.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

Correspondents sending minerals should number or otherwise designate each specimen, and legibly mark the package containing them with name and address of sender.—W. S.—The hard stone is a red porphyry, the one containing bright specks of pyrites is quartzite. The large one contains silicate of alumina, iron, and lime.—Miss E. M. K.—You failed to number or otherwise designate the minerals. The large one contains orthoclase and biotite, the smallest the same. The others are orthoclase, kyanite, milky quartz, muscovite and some biotite, and tourmaline.—F. K.—It contains alumina, lime, and oxides of iron and chromium.—E. M.—The powders sent were found mixed. The mixture contains sulphate of quinia and chalk, milk sugar, and a phosphate.—The minerals in a tin box marked Eagleswood (no letter) are mostly hornblende. The red substance is a zinc ore. It contains oxides of zinc and manganese. The large crystal is carbonate of lime—calcite.—E. A. S.—We cannot tell anything about your minerals without having seen them.

COMMUNICATIONS RECEIVED.

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

On Ashes. By J. M. B.
On Formulas of Problems. By H. M.
On Curving a Base Ball. By H. C.
On Guns and Armored Vessels. By J. M.
On a Perpetual Motion. By C. M. L.
On Reducing Silver Ore. By I. H. H.
On the American Toad. By C. F. S.
On the Mind. By J. H. R.

Also inquiries and answers from the following:

W. H. R.—A. C. F.—J. E. T.—N. B. H.—P. C.—C. M. —T. A. P.—A. M. S.

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 makes the best magnetic motor? Who makes crucible steel? Who makes or sells ice machines? Who sells the best modern books on engineering. Who deals in lithographic printers' materials? Who sells books that treat upon lithography?" 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.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 12, 1877,

AND EACH BEARING THAT DATE.

[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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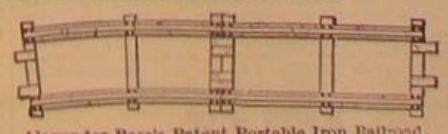
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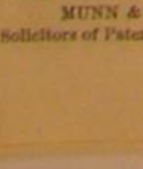
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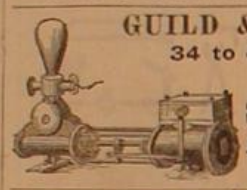
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THE MANUFACTURE OF SHOT.

Lead shot, though sometimes made of lead alone, are almost always formed of an alloy of arsenic and lead, the arsenic being introduced in the form of arsenious acid or the sulphuret (orpiment). The object of the addition of the arsenic is to render the hard brittle qualities of the lead, which is contaminated by iron and antimony, softer and more ductile and of the proper consistence, when melted, for taking the globular form. Owing to the rapid decomposition of the arsenic it is treated by itself in the bottom of the melting kettle shown in Fig. 5. A cover is placed over the substance, and its stem, which rises up through the kettle, is fastened down. The lead is then added above the cover, and when melted the cover is lifted out of the liquid mass, which instantly becomes permeated by the arsenic beneath. The alloy thus produced contains 45 lbs. of arsenic to the ton of lead, and is known as "temper." This again is added in the proportion of 1 per cent to the pure lead, and thus the shot alloy, containing a very small percentage of arsenic, is produced. The making of quantities of the temper at a time is a great convenience, as the proportion of arsenic in the shot is thus kept uniform while the melting can be done in the ordinary kettle in the summit of the shot tower. The temper pots hold about a ton of metal each, and the cooled product has a brownish gloss distinguishing it in marked manner from the dull hue of the pure lead.

The ascent of a shot tower cannot be commended as either agreeable or interesting. To go round and round a spiral staircase, just wide enough for the body and no more, is to get into a bewilderingly dizzy state. Besides, after developing about one fourteenth of a horse power with one's leg muscles, a sensation of fatigue follows, which is not easily got rid of. After the visitor has reached the uppermost story and regained both his equanimity and his wind, he is treated to a new sensation, which becomes the more marked in accordance with the force of the prevailing breeze. The tower rocks like a ship at sea—sometimes so much as to dash some of the molten lead out of the kettle. Of course there is no danger, because the edifice is usually constructed with an iron frame, which is not only strong but elastic, while the brick filling gives additional stability. But, as at the famous tower at Pisa, to the summit of which no one probably ever ascended without, on looking over, involuntarily recoiling with the expectation that the edifice surely was about to fall; so, in the shot tower, one's powers of perception and reasoning faculties are at direct variance: and nervous people are liable to receive a disagreeable shock in consequence.

Up in that lofty apartment (Fig. 1, represented in our large engraving) the visitor finds two men, their hands incased in thick bags, and grasping heavy iron ladles with which they dip out the molten metal from the kettle, and pour it into the collenders. Here is the source of that dazzling stream, which, passing down through the center of the structure, salutes the climber of the narrow stairs at every turn. Blistering as the molten metal is, the men dash their ladles into it as if it were water. This is hard labor, and rapid besides, for the lead runs through the collender almost like quicksilver: while if it is allowed to become a little chilled in the

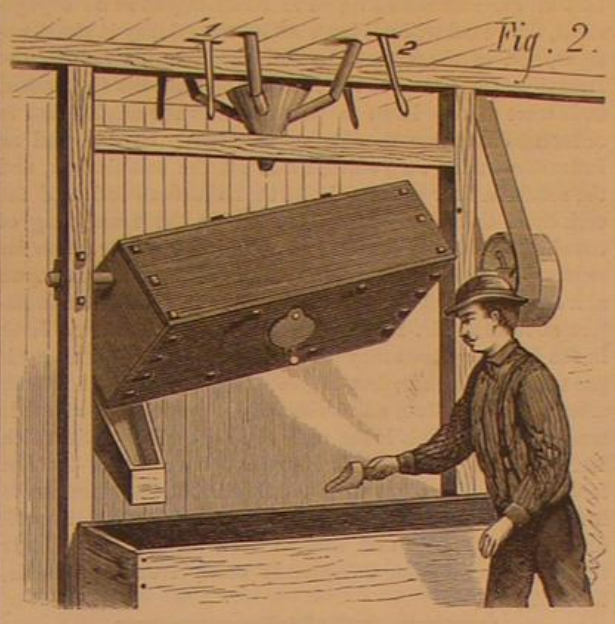


Fig. 2.

bottom of the vessel, then the holes are stopped, and the careless workmen have no easy job in cleaning them. Five tons of lead are often thrown down in half an hour in the establishment we visited. The collender is simply a copper pan, the bottom of which is perforated and which rests in an iron ring. A long handle from the latter allows of the collender being fastened over the well. In the bottom of the collender is placed a layer of the dross which rises to the surface of the lead during melting. This in a measure checks the too rapid escape of the melted metal, and is thought to have the effect of increasing the rotundity of the shot, possibly by expediting its cooling as it passes through. The holes in the collenders vary from $\frac{1}{60}$ to $\frac{1}{32}$ of an inch, but the shot are of larger diameter than the orifices. In falling to the base of the tower the particles of semi-fluid lead, acted upon alike over their whole surface by a current of air, are made to assume the globular form, and by the time they reach the bottom they are sufficiently hardened by cooling to bear the shock of striking the surface of the water in the well below.

The size of the shot is only approximately fixed by the sizes of the holes in the collenders. The mass is always larger than the hole from which it exudes, and as the period of dropping is not exactly uniform, perhaps half a dozen sizes are produced from the same sieve. Again, large sized shot require to be dropped from a greater height than small sized, and while in some cases 100 feet is sufficient, in others an elevation of 150 feet is hardly enough. Buck shot, as will be explained further on, are not made by the dropping process at all, owing to their size. Various devices have been proposed for shot-making, having for their object the abolition of the tower. One process consists in pouring lead upon a revolving table on which is placed a cylinder of perforated sheet brass. The table is revolved with a velocity of 1,000 feet per minute on the periphery, and the lead is thrown through the perforations on the side, forming round shot, which strike against a linen screen placed to intercept them. A method has also been patented in this country for dropping shot through short distances but subjecting them meanwhile to a powerful air current which cools them.

After the shot have reached the bottom of the well, they are at once lifted out by an elevator and thrown upon an inclined drying table over which they slide, falling ultimately into a wire gauze rotating cylinder. Here they are rolled and ground together, and in this way the minute burrs upon them are removed. From the cylinder another elevator lifts the shot upon a screening table, Fig. 3. This consists of a series of planes arranged at gradually decreasing heights. Between each there is an interval. The shot being started at the end of the highest plane will, if perfect, roll from one plane to another, jumping over the intermediate spaces; if imperfect, however, the latter become pitfalls, into which, sooner or later, it tumbles and is carried off into a receptacle, the contents of which go back to the melting kettle. The good shot, after passing this ordeal, reach the separators. It should be explained that there are usually several tables, each being devoted to a different size of shot and its approximating sizes. This

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THE MANUFACTURE OF SHOT. POURING THE MELTED LEAD.

Scientific American.

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THE LATEST BRITISH NAVAL FAILURE.

A strange fatality seems to attend the vessels of the English navy. For more than two years past accidents and blunders have occurred so repeatedly in the finest and presumably best built ships that the conclusion appears imminent that the superior skill of English ship constructors, engineers, and seamen is fast leaving them. Not long ago the Orontes, a splendid new troop ship, after a highly satisfactory two hours trial of her engines, was sent to St. Helena. Hardly had she started on her voyage than (to quote the *Engineer*) "the engines broke down utterly, and the ship is now lying disabled in the harbor."

But the hugest blunder of all, if we may credit Mr. E. J. Reed, the late chief constructor of the navy, has been perpetrated in the designing of the famous Inflexible, supposed to be the most powerful vessel of all the English ironclads. She is built on the citadel principle; that is to say, she has a heavily plated central portion wherein are guns, machinery, and magazines. Before and abaft this strong portion the ends are unarmored, it being considered that even if such portions are destroyed in action the fighting capacity of the ship will be none the less. But now Mr. Reed says that if these ends do happen to be destroyed in an engagement, the vessel will not have sufficient stability to stand upright, and in short that she will capsize. On visiting the Inflexible from time to time he found that the unarmored ends were so very large in proportion to the citadel that in order to determine the doubts suggested, he designed an Inflexible in his own office, made all the calculations, and the result he now affirms shows that the destruction of the cork-lined extremities would determine the foundering of the ship. As the Inflexible has been under construction for nearly four years, and as two similar ships have been begun at a cost of about 6 million dollars, John Bull's consternation at reading Mr. Reed's damaging assertions spread forth in the London *Times* may be imagined. The Admiralty is put upon its defense; but *Engineering*, after reviewing both sides of the question, admits that the "position of affairs is most serious." This is the second disagreeable truth which Mr. Reed has presented to his countrymen within the last few weeks. The other was that England did not possess an ironclad which could not be promptly destroyed by well managed torpedoes, and that in view thereof the quicker she stopped building enormously costly iron war vessels, the better.

GLIMPSES OF ATLANTIS.

The sedimentary rocks of our Atlantic States aggregate a thickness of nearly 45,000 feet. The manner in which the sand, gravel, mud, and so on, which formed these rocks, was distributed over the bed of the sea which rolled where our continent now lies, proves beyond a doubt that they came from the north and east. They represent the detritus of pre-existing lands, the washings of rains, rivers, coast currents, and other agencies of erosion; and since the areas supplying the waste could scarcely have been of less extent than the new strata it formed, it is reasonably inferred that land masses of continental magnitude must have occupied the region now covered by the North Atlantic before America began to be, and onward at least through the palæozoic ages of American history.

It is not to be imagined that the ante-American sea was 45,000 feet deep. When the earlier palæozoic strata were forming the water was evidently shallow, and in some parts broken by islands. From time to time the sea was deepened by the sinking of its floor; and as the successive strata were laid down the subsidences for the most part more than kept pace with the thickening deposits. Now and again the movement was reversed, as when the Green Mountain range was uplifted; and occasionally deposition exceeded subsidence, or slight elevations brought the sea bed near to the water level. Previous to the carboniferous period evidences of shallow water are common; and after that time successive low-level land areas repeatedly occupied the eastern half of what is now the Mississippi basin.

While the new America was thus forming the ancient Atlantis was no doubt sinking as well as washing away. When its final disappearance occurred remains to be determined; quite recently, however, two or three lines of scientific research seem to converge in support of the truth of the ancient story, long considered mythical, in regard to the geologically recent occurrence of that remarkable catastrophe. Archæo-geology has sufficiently demonstrated that the memory of man runs back vastly farther than history has been willing to admit; so that there remains no inherent improbability in the story the Egyptian priests told to Solon. All that modern science asks is, whether there is any other evidence of the recent existence of Atlantis.

Since the exploration of the North Atlantic sea bottom for telegraphic purposes proved that no elevations or depressions inconsistent with the safe laying of cables were to be found between Newfoundland and Ireland, it has been popularly taught that the Atlantic lies in a vast trough with a comparatively regular bottom. A wider range of soundings made by the American ship Dolphin, the German frigate Gazelle, the British ships Hydra and Porcupine, and more recently by the Challenger, quite overthrows the popular idea, proving the Atlantic bed to be rather a double trough, the deeper depressions separated by a mountainous ridge of great altitude running north and south, almost midway between the existing continent. From the variations in the soundings along the ridge there is every reason to infer that it is a line of broken country, the higher peaks reaching the surface north of the equator in the Azore Islands, and further south in St. Paul's Rocks, the Islands of Ascension, Tristan d'Acunha, etc. On the other side of the ridge the water deepens, the bottom presenting a surface diversified by hills and valleys, such as could be carved out only when the sea bed existed as dry land.

From the soundings made and collated by the officers of the Challenger expedition, a chart has been prepared, showing by soundings, first, the Atlantic areas having a depth of over 2,000 fathoms, and second, the areas ranging between 1,000 and 2,000 fathoms: the narrower areas having a depth of less than a thousand fathoms, showing white. By far the greater portion of the sea bed south of 50 N. L. exceeds the depth of 2,000 fathoms. The area of medium depth covers the northern sea down to an irregular line between Newfoundland and England. Thence a narrow isthmus (beginning about 52° N. L., and 30° W. Long. from Greenwich) connects the northern table land with what has been denominated the Dolphin Ridge—a seal-shaped area with its head to the north and its tail joining (at about 15° N. L. and 45° W. L.) another ridge called the Connecting Ridge. The latter puts out from the South American shore just north of the Amazon's mouth, and extends from about 19° N. L. and 50° W. L., southeastward to a point on the equator about Long. 10° W., where it turns abruptly south and forms the Challenger Ridge, which broadens southward, but is not mapped below 40° S. Lat. Just north of Tristan d'Acunha the Challenger Ridge sends off an arm, which, curving to the northeast, joins the coast of Africa.

Here unquestionably we have the backbone of the ancient Atlantic continent; and in a recent lecture in London one of the Challenger staff has reviewed the evidence of soundings touching the general contour of the "lost Atlantis." Its valleys and hills are not such as could be formed by any natural irregularity in the deposition of sediments, nor by submarine elevations; they have been carved by agencies acting above the water level. Along the ridge there are four points which remain unsubmerged—the Azores, St. Paul's Rocks, Ascension, and Tristan d'Acunha. In the deeper basins, the Bermudas, Fernando de Noronha, Trinidad, and St. Helena rise to the surface, in some instances not far distant from depths exceeding 3,000 fathoms. A group of such soundings under the equator (not far from where the general ridge makes the angle separating the Connecting Ridge from the Challenger Ridge) give evidence of an ancient valley line. Supposing the continent raised until this valley became dry land, the high peaks (now islands) near by would rise to Himalayan heights, and the ridge itself would average about 1,500 feet. Even under the equator such elevations would be capped with snow, if the atmospheric conditions were at all as now. The lower levels along the mountain ridge would present every variety of climate, according to the height; and with such a line of communication many serious problems of plant and animal migrations across the equator during the geologic ages could be easily solved. In the North Atlantic regions the general elevation of the ridge is probably not more than 9,000 feet, unless the original depths are masked considerably by a deposit of globigerina—ooze.

Thus deep sea exploration confirms the report of geology that Atlantis really existed; and palæontology also bears witness to the same great fact. Still more, it testifies that the final disappearance of the buried ridge did not occur until comparatively recent times. The evidence on this point was reviewed some eight years ago by Professor Unger, who had been led to believe that a land connection must have existed between Europe and America, as late as the tertiary period, by a comparison of the recent and fossil floras of the two continents. Other evidence of like nature may be found in Professor Gray's review of the history of the gigantic redwoods (*sequoias*) of California, reprinted in "Darwiniana."

With such support the traditions of the ancient world, on both sides of the Atlantic, begin to read like something more than empty myths. The Egyptian priests, it is more than likely, were reciting veritable history when they told Solon about the islands of continental magnitude that formerly existed in the outer sea beyond the pillars of Hercules, but had sunk beneath the waters. And it is not impossible that the mighty kings of Atlantis may have invaded Europe and Africa, as the Egyptian books narrated, and overrun those countries as far as Greece and Egypt.

The story of the sinking of Atlantis during a time of floods and earthquakes was preserved with even greater fulness of detail on the American continent, if there is any truth in the representations of Brasseur de Bourbourg. That student of Central American monuments and traditions asserts that not only was the story of the submergence of a great country to the eastward widely spread among the natives and frequently referred to in their writings, but that seasons of humiliation and prayer were observed in commemoration of such disasters—both princes and people humbling themselves before their divinity and praying that the calamities which had overtaken their ancestors might never be repeated. These great convulsions are specially dwelt upon in the Indian traditions, and one or two minor ones are mentioned, when the land was shaken by frightful earthquakes and the waves of the sea combined with volcanic fires to overwhelm and engulf it. By these convulsions the land was swept away and submerged, but few of the inhabitants escaping in boats or finding a refuge on the tops of high mountains.

To the evidence of tradition de Bourbourg adds that of language. The words *Atlas* and Atlantic, he says, have no satisfactory etymology in any language of the Old World. On the other hand, the radicle *atl* is characteristic of the

Nahuatl language, which played so important a part in Mexico and Central America. It signified water, war, and the top of the head, and furnished a series of words, such as *atlan*, on the border of or amid the water; also *atlaça* (preterit, *atlas*), to combat or be in agony, and to hurl or dart from the water. *Atlan* was the name of a native city at the entrance of the Gulf of Uraba, in Darien. The same combination appeared also in *Quetzalchohuatl*, the name of the quetzal plumed serpent god of the Aztecs.

We are not aware of any geological reason for doubting the possibility of the lingering of Atlantis as an archipelago down to post-tertiary times, and its final submergence within the period since man appeared. The probability of its continuance hinges entirely on the credibility of human traditions. In the absence of conflicting evidence, the concurrence of testimony from people so widely separated as the ancient Greeks and Egyptians on the one side, and the Central Americans on the other, may in some minds count for a great deal. At any rate it must be admitted that Atlantis *has existed* as a substantial reality.

AN ENGLISH MECHANIC ON AMERICAN MACHINES.

Dr. John Anderson, C. E., contributes the report on machines and tools for working wood, metal and stone, at the Centennial, to the recently issued volume of reports of the British Commissioners and Judges. As one of the most eminent of English mechanics and engineers, and besides an observer of much acuteness and intelligence, Dr. Anderson is capable of pronouncing a just opinion of our productions —one indeed which Americans will look for with interest and read with respect. Most of Dr. Anderson's report is taken up with descriptions of machines which especially impressed him, and which need not be noted here. He has a straightforward way, however, of telling what he thinks, that enables us to convey pretty clearly the drift of his opinions by a sentence now and then abstracted.

As was the case with most of our foreign mechanical visitors, Dr. Anderson was first struck by our multiplicity of special and labor-saving devices. The invention of these he thinks is our "natural forte and worthy of the old stock probably quickened by the peculiarly favorable circumstances under which they live. It was the display made in this section of the exhibition which most conspicuously brought out the enormous strength of America as a producing power." "No mere words," he says, "can convey an idea of the high standard of excellence of American watch making machinery. Sellers' tools were without a parallel in the history of exhibitions either for extent, money value, or for originality and mechanical perfection." For torsional, tensional, and malleable qualities the samples of American iron and steel "were equal to the best of any country." "The impression is left upon the minds of European visitors, that American competition in machine tools will soon be upon us, but that the competition will not be in regard to price, but rather for high quality and productiveness and the capabilities of doing more work with a given expenditure on labor." The concluding paragraph of the report which is the conclusion drawn from the whole, is suggestive.

"In past times England has been the nursery ground of the manufacturing system, her factories have been visited and her system of cotton and other textile manufactures copied by all nations, but the time seems to have arrived when we shall have to visit America in the same way and for the same purpose, in regard to the production of other things, and there is no time to be lost if we mean to hold our own in the hardware trade of the world, at least in regard to the class of things that are required in large number or quantity. * * When we consider the enormously greater area of the American continent, it is a matter of vast importance, that tools have taken such a hold on the American mind which will influence the civilization of the Western world for ages to come, and will exercise a powerful effect not only on that continent, but on Australia, China, and the world generally: this therefore has a profound significance which can scarcely be overrated."

PROGRESS OF THE MISSISSIPPI JETTY WORKS.

Captain Eads' latest report of progress upon the improvement of the South Pass of the Mississippi river is most gratifying and leaves no question as to the ultimate triumphant success of the entire great work. Careful examinations have been conducted from time to time with the result of showing a steady increase in width and depth of the channels, thus bringing to Captain Eads' theories the strongest confirmation. For two years work has now been going on upon an unused outlet of the vast river. Up to the present time the concentration of the water flowing across the sand bar at the mouth of the Pass by the jetties has created a channel over 200 feet wide and in no place less than 20 feet deep, where only about 8 feet previously existed. The concentration of the water flowing over the shoal in the river at the head of the Pass has likewise created a channel over 400 feet wide, in no portion less than 20 feet deep and 30 feet deep in the center, where before the depth was scarcely 14 feet. During the time in which a portion of the flow into the Pass was interrupted by the works at its head, and while the current consequently slackened, Captain Eads states that a temporary deposit took place in the Pass and between the jetties. But the gradual restoration of the normal flow into the Pass through the new channel at its head has already begun to enlarge the Pass again and, continues the report, "has, since this restored flow commenced, removed from between the jetties within the past three months over half a million cubic yards of deposit, and given through more than half the length of the jetties a much larger and deeper channel than ever previously existed, the size of which is already throughout more than 2,000 feet, 28 feet by 300 feet, or that required to entitled us to the fifth payment from the United States, while many hundred feet of it exceeds 30 feet by 350 feet."

The reformation of the bar in advance of the jetties, which many engineers believed would occur, is effectually prevented by the gulf current athwart the mouth of the Pass, which deepens the outer slope of the bar and sweeps away any such portion of the discharged sediment as the river current fails to carry to unknown distances seaward. At the head of the Passes the river has a width of over 9,000 feet, and yet is brought under complete control by Captain Eads' works, which are so designed as to allow of the increase or limit of the discharge into the South Pass if hereafter necessary with but little additional outlay. Captain Eads concludes his report and at the same time announces the splendid success which has crowned this application to his genius and ability in the following terms:

"I may add with absolute certainty, that this entire system of works is now so far completed that no financial difficulties can intervene to arrest the processes of nature which are constantly operating to enlarge and perfect the desired channel through them.

AMERICAN REPRESENTATION AT THE FRENCH EXPOSITION.

There has been some doubt expressed recently as to whether the Paris International Exposition would take place in 1878, it being surmised that the unsettled condition of affairs in Europe would render its postponement necessary. Late advices, however, show that there is no basis for this supposition, and that the work of erecting and making ready the buildings is being vigorously prosecuted. The N. Y. *World's* correspondent states that the masonry and brickwork are in place, that the great iron works of Creusot and Fives-Lille are competing in the matter of rapidity of erecting the frames of the structures, and that the French Commissioner General has officially announced the certain completion of all by the spring of next year. All nations with the exception of Germany and the United States, have accepted invitations to participate and have already entered upon the organization of their representative displays. Even Russia and Turkey, despite the war, are to take part.

Germany's refusal to contribute is owing to the unhealed breach between herself and France. Our own failure to make the necessary preparations to ensure the representation of our industries is, as is well known, due to the failure of Congress to attend to the matter before adjournment. It is stated that already large numbers of Americans are in Paris endeavoring to make arrangements as to space, etc., and that on the other hand, the "French are burning with desire to strain a point in favor of Americans by recognizing any body of men, or any invividual having a shadow of official authority, but until that person shall appear they are obliged to hold that the United States is non-existent for the purposes of their mighty show."

It seems to us that if this view of affairs is correct a great deal of regret over the so-called negligence of Congress is being wasted over here. Let the representatives of American manufacturers, who "run from the legation to the office of the French Commission and back again without finding anyone to give them a helping hand," help themselves. Let them organize their own commission and apply to the President for official recognition. We do not see that any further formalities are required, at least in the face of the statement quoted in the last paragraph. Then let them or their principals furnish money and invite subscription from every one who is interested in having an American display in the show, and with the funds so raised go ahead. It is getting to be an altogether too prevalent notion in these days of World's Fairs that we cannot get up a respectable display of our productions without an appropriation and a new army of office holders to spend it. Our unfortunate experience at Vienna goes to prove the fallacy of this even if to every thoughtful person the same were not already apparent. It is radically absurd to sit grieving over what Congress did not do, when the way out of the difficulty is perfectly clear, and it is more absurd to wait for the possible action of Congress in granting money when it meets next winter. Even if money appropriated in December would not come too late to secure a proper official organization, in the present state of the national finances, when retrenchment is everywhere being enforced, Congress should not devote a cent to assisting any one or any class of the people to advertise themselves in Paris.

FAST FREIGHT RAILWAY TRAINS.

The subject of moving freight at faster and cheaper rates was one of the principal topics of discussion at the late meeting of the master car builders' association. The competition of water conveyance, together with the general depression of business, makes the demand imperative that there be some method by which freights may be moved at cheaper rates than those now employed. The solution of the problem is one that effects, not only railway companies, but the public at large. Stockholders are interested in a fair percentage for the stock they hold, while the public are more interested in some cheap, yet rapid method of conveying goods and agricultural products to their various points of destination. To those railways that come in direct competition with lake, river, and canal transportation, the demand is imperative, that to secure returns to stockholders, some energetic action must be taken that will enable them to lower their rates of transportation.

It is claimed by some railroad men, and men, too, who have had long and varied experience in such matters, that it is more economical to run freight trains at a high rate of speed, say twenty-five miles per hour, than to run a train a one half that speed. This will be one great benefit in the competition with the water routes. The advantages claimed for this high speed are, that when a train is once under way less fuel is consumed, and less power is actually expended than when moving at the low rate of speed. In proof of this, experiments were made on the Lake Shore Road. An engine with dynamometer attached was run from Buffalo to Chicago and a record kept the entire distance, both at twenty-five miles per hour and at twelve miles. The fuel was weighed and everything recorded that was thought of value. The result showed that in economy of fuel, the fast speed had the precedence. Resulting from this is the economy of power in moving a train at quick speed, as, after once started, less power is required to keep the train at that speed than if kept running at a low rate of speed, as, at the less rate, the engine is kept under strain twice as long, and during this time a large amount of heat is lost by radiation. With the fast speed, the train hands would be on duty but half as long and a consequent saving of wages paid, and finally but half as many cars would be required to transport the same amount of freight.

With fast speed trains, it will be necessary to look well to track and rolling stock. If the track be high in some places and low in others, causing the train to be tossed from one side to the other, it will result in wear and destruction. Car wheels must be round and not eccentrics. With the movement of the train these defects will be augmented and result in danger and damage. It was said by an official, who was connected with a very important line: "If you car men will give us the control of our trains through some continuous train brake, we will dispense with from one third to one half of the number of cars now in use, we will transfer grain from Chicago to New York in one half the time we now do it in, we will move our trains at less cost to you for repairs, as has been demonstrated by trains running over this line for a series of years at twenty-five miles per hour termed 'immigrant trains.'" He also said, that the repairs on these trains is less per number of cars than in the trains moved at twelve miles per hour.

Surprising as may seem the statements made before the association, the facts of the economy of fast speed freight trains was acquiesced in, but it was thought advisable not to attempt such high rates of speed unless these trains were equipped with suitable train brakes, and the engine and tender provided with steam brakes always ready for application.

Nordenskjold's Next Expedition.

For Professor Nordenskjold's expedition, which is to set out from Gothenburg, in Sweden, in June, 1878, a vessel has already been chartered for 150,000 Swedish crowns (about $25,000). King Oscar has contributed 50,000 crowns from his personal revenue, but the burden of the expense will be borne by the friend and patron of Nordenskjold, a merchant of Gothenburg named Dickson. The route of the expedition will be from its starting point to the North Cape, thence eastwardly through the Polar Sea to and through Behring's Strait, thence along the eastern and southern coasts of Asia, through the Red Sea, the Suez Canal, and the Mediterranean Sea to the Atlantic Ocean, and return home in the autumn of 1879.

Smoke Screens for Torpedoes.

History is repeating itself again. In his veracious chronicle of New York Mr. Diedrich Knickerbocker says that, when an English ship sailed into the harbor, and arrogantly demanded of the primeval Dutch, the prompt surrender of their possessions, that portion of the phlegmatic population which had settled in Communipaw raised such a cloud of smoke from their huge pipes that the piratical British never discovered their existence in the midst of the dense fog. A similar plan is now proposed for the protection of torpedo boats from the fire of an attacked ship. Hale's rockets are to be provided with smoke balls and these discharged from the launches on igniting envelope both the assaulting craft and that assaulted in such a thick cloud that it will be practically impossible for the latter to use her electric light with any efficacy, or to sight her guns at her concealed antagonists.

American Institute Exhibition.

Our manufacturers are now fully awake in the matter of exhibitions (thanks to the "Centennial,") and so far as their limited space is concerned, we are assured the coming exhibition of the American Institute of this city will be of more than usual value and novelty. For information address the General Superintendent.

RECEIPT FOR HOG CHOLERA.—Take one teacupful of pulverized copperas and mix with one gallon of salt; and salt the hogs twice a week regularly. This is said to be a sure preventative, and has been known to cure in many instances after the disease has commenced.

PARTIES desiring information in regard to the horse-collar stuffing machine, illustrated in last number, will address Mr. B. F. Grayson, Jr., Luray, Page county, Va.

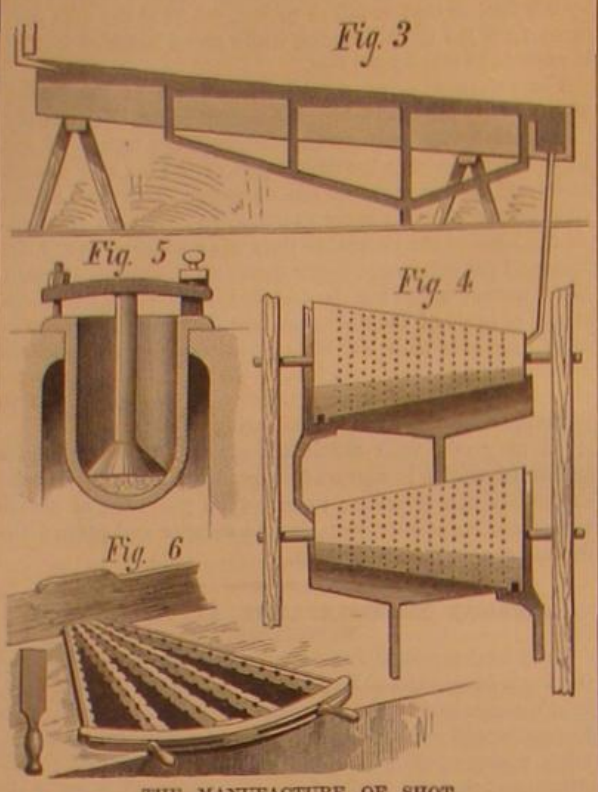
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is for convenience in future separating. The shot are next elevated to the top cylinder of a series, arranged on an incline. Two of these cylinders are represented in Fig. 4. They are conical in form and inclined, and are covered with perforated sheet brass. Each cylinder serves as a sieve for a particular size of shot, retaining that and allowing all smaller sizes to escape. The shot, as the cylinder revolves, traverse its entire length, and then the small ones run out into the next cylinder below, and thus the sifting goes on until each cylinder has picked out the particular class of shot to which it is adapted.

The sizes of shot are standard. The smallest is known as "dust," and then comes No. 12, which is 0·05 inch in diameter, 2,326 shot going to the ounce. The sizes then increase by one-hundredths of an inch to up to twenty-three hundredths, of which there are 24 shot to the ounce.

The shot being now assorted, polishing alone remains to be done. This is accomplished by placing the shot together with plumbago in the box, Fig. 2, which is rapidly rotated. This imparts the glossy black smoothness demanded by sportsmen. The shot are then weighed, bagged, and are ready for commerce.

Buck shot, which range in size from twenty-two to thirty-eight hundredths of an inch, are moulded. The moulds represented in Fig. 6 consist of a series of pivoted bars, the outer pair of which have handles. The upper edges of these bars are hollowed to form the moulds, so that when they are closed together, the opposite halves of each cavity unite, and it is only necessary to pour the lead into the apertures. The shot are thus at once moulded to the proper size, so that rumbling and polishing only are subsequently required.

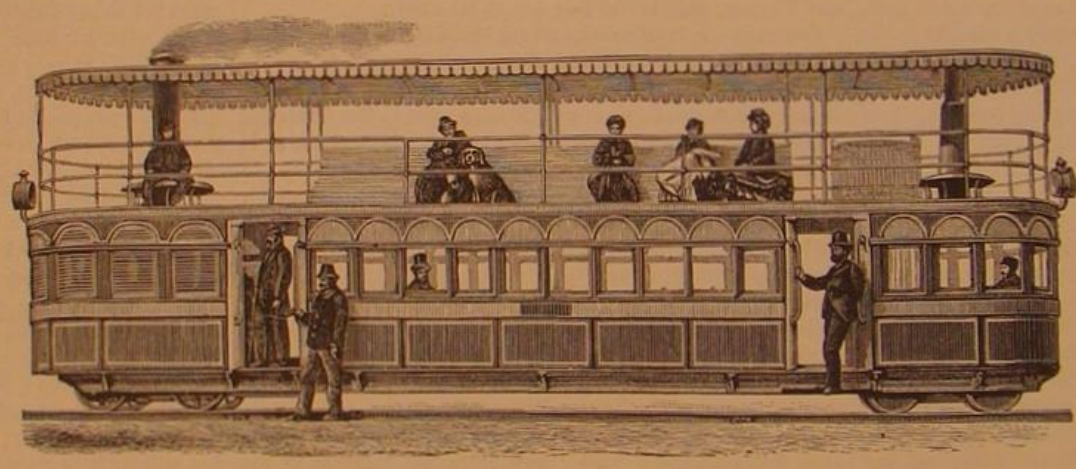


THE MANUFACTURE OF SHOT.

A SWISS STEAM TRAMWAY CAR.

In the annexed engraving, from *La Nature*, is represented a steam car used on the route between Lausanne and Echellens, Switzerland. The length of the line is nearly nine miles. There are numerous curves; some having a radius as small as 62 feet. The speed at which the car travels is about 15 miles per hour, and the time of passage, including eight stoppages, 50 minutes. The steam engine and boiler is located in one end of the vehicle, similar to the Philadelphia street steam cars, and directly over the trucks. The heating surface of the boiler, according to the builder, M. Brunner, is 143 square feet, corresponding to a motive power of 25 horse. The consumption of fuel is 220 lbs. per trip. Coke is used in the towns, and soft coal during the journey. The tractile power is 1,650 lbs., and the car can be stopped by its brake within a distance of 20 feet.

The vehicle has two stories, with 24 seats in the lower one, and places for 32 people on the deck. Eight more passengers can be carried in the lower end compartment. No turn-tables are used, the car running in either direction. The total length is 41·2 feet, breadth 7·6 feet, height 13·7 feet. The weight, empty, is 11·5 tons; or, with a load of 64 persons, about 16 tons. There are many branch roads in this country where a car similar to the above might be used, and a great saving be effected in cost over the locomotive and ordinary cars now employed.

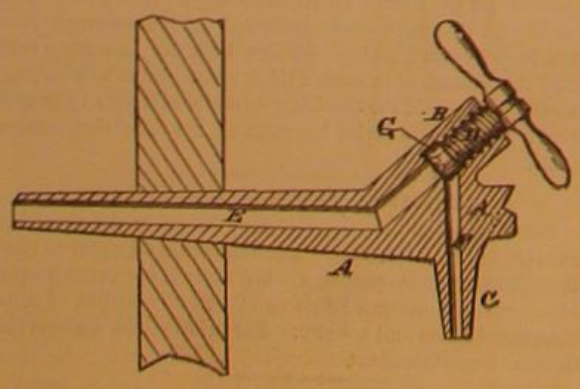


SWISS STEAM STREET CAR.

IMPROVED FAUCET.

This invention is designed to furnish a faucet so constructed as to prevent leakage, and enable the valve-packing to be readily renewed should it become worn.

In the engraving A represents the receiving tube, B the key seat, and C the discharge pipe. The passage, E, through the receiving tube near the outer end of the faucet, is inclined upward at an angle of 45°, so as to meet the lower end of the key, D. The passage, F, of the discharge pipe, C, passes down vertically entering the cavity of the key seat, B, at an angle of 45°, and just above the vent of



the passage, E. The key, D, screws into its seat, and has a rubber button or packing, G, secured detachably to its forward end by a small screw. The rubber button, G, is unaffected by the liquor, consequently it lasts almost as long as the metal parts of the faucet: but, should it become worn or frayed by use, it can readily be detached by removing the small screw, and replaced by a new one.

Patented through the Scientific American Patent Agency April 2, 1877, by Ralph Hathaway, of Memphis, Tenn.

Esquimaux Implements.

In looking up objects of interest in my museum at South Kensington for the Westminster Aquarium, I have re-arranged a very nice collection of Esquimaux implements. These were obtained from the Esquimaux at Kotzebue Sound, Behring's Straights (latitude 70°), Arctic Ocean, and presented to me by Commander Hill, R.N., June, 1865. These articles are as follows: A set of instruments used for producing fire. These consist of a bow made of walrus tusk, a round piece of stick like a large cedar pencil, and a piece of wood with cavities in it, corresponding with the end of the stick. The stick being worked very quickly by means of the bow like a drill, smoke and then fire ultimately ensue. Neither Mr. Searle nor myself can produce the fire, but can make the top of the drill very hot. To the Esquimaux, who have no lucifer matches, this fire-stick must be of the greatest importance.

Tusks of the walrus are of the greatest value to the Esquimaux. We observe in the collection several articles made of this—namely, a netting-needle, the same as our own—three other needles—I cannot conjecture their use. They are about eight inches long, pointed at one end, blunt at the other, and a small hole bored through them about half way down. There is also another walrus ivory implement, used for plaiting or twisting lines. There are four hooks very unlike the hooks used by civilized nations. They are in the shape of a letter U, with a barb running down from the top of one side nearly across to the center. The hook is made of some very hard bent wood, but the barb is made of bone or ivory, and very sharp pointed. There are two kinds of baits, namely, a rough imitation of a fish, also in bone, which is evidently a spinning bait. Holes are drilled down the side, what the exact use of these is I am unable to determine. A very interesting specimen of a harpoon demands our attention. It consists of a heart-shaped termination. The edges of this weapon are very sharp, and are made of a portion of some shell. The material into which this shell is set is, I have ascertained by burning, to be some resinous gum, a native-made rope with two barbs of bone standing backwards is let into the hollow of this harpoon, and cemented fast by the gum. The strength evidently is trusted to the barb, the line and the shell are used for the lancing and penetrating purpose. The use of the flying lasso (or bolas as called in South America) is not unknown to the Esquimaux. It consists of strings made of the intestine of some animal; to the end of each string is attached a heart or pyramidal shaped bit of walrus tusk, about the size of a walnut; one has eight ends to it, the other nine. The bolas is thrown by hand. It is first of all twirled two or three times round the head; and then is sent flying through the air like a large cobweb; it will lap round any object it meets with the greatest quickness; it is used by the Esquimaux for catching birds. I think the idea may be applied to catching such birds as partridges. It would require some skill and practice to use it properly, but therein it would cause some sport. At the ends of each bolas are attached a few birds' feathers. In order to avoid the terrible glare of the Arctic snow, we find the Esquimaux have invented snow spectacles. These consist of a piece of wood cut out in the shape of a spectacle; where the glass should be in ordinary spectacles we find two very fine slits. This apparatus I should think would be admirably adapted to drivers of railway engines, who have to encounter snow, wet, and hail, as the engine rushes through storms at express pace. The eye itself is entirely protected, while the eye gets a fair lookout through the slit in the wood. The ingenuity displayed by these hardy Esquimaux is very interesting and instructive.—*Frank Buckland, in "Land and Water."*

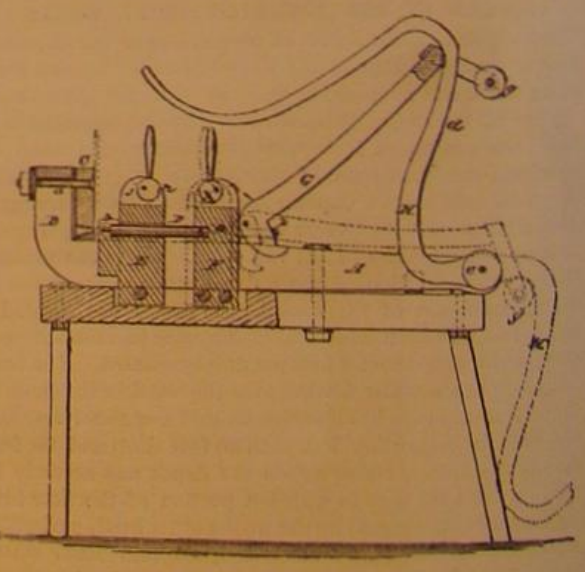
Proposed Utilization of a New York Reservoir as a Science Museum.

Messrs Vaux and Radford, architects of this city, have recently suggested the utilization of the ground on which the 42d street reservoir (which structure is no longer required for water distribution) stands as a site for a permanent museum of science. This is an old idea, which was quite fully elaborated by Professor C. F. Chandler and Mr. E. D. Lindsay some five years ago. It was then proposed to leave the reservoir as it is, removing only the inner dividing wall, the material in which could be used for building porches, etc. With the reservoir walls serving as those of the building, a glass and iron superstructure alone would be needed. Mr. Lindsay has prepared drawings of quite an imposing structure, which according to this plan would roof over nearly four acres of ground.

IMPROVED METAL PUNCHING MACHINE.

Mr. Adam Robertson, of Blanchardsville, Wis., has patented through the Scientific American Patent Agency, May 22, 1877, the novel metal punching machine herewith illustrated.

B is a right-angled support for the dies, that is formed on the end of the bed, A. C is a die that is provided with several holes for punches, and is adjustably attached to the support, B, by a bolt, *a*. D is a follower that moves in a guide, E, attached to the bed, and F is a movable block that is attached to the end of the follower and slides in the slot in the bed. The follower, D, carries a punch, *b*. G is a cam lever that is journaled in ears, *c c*, attached to the bed of the machine, and bears against the block, F. The lever, H, is curved in the form of an irregular volute from *d* to its fulcrum, *e*, and its outer end is bent into convenient form for a handle. A fork, *f*, is formed on the end of the lever, G, for supporting a friction roller, *g*, between which and the lever, G, the lever, H, passes. A loop, *i*, is attached to the block, F, and passes around the lever, G, for drawing the follower back and removing the punch from the metal. The fulcrum of the lever, H, being in the end of the bed, and that of the lever, G, being in the ears near the bed, brings the strain in nearly a straight line. The guide, E, and block, F, are provided with ears, *h*, to which fluted eccentrics, *j j*, are pivoted for clamping tire, for the purpose of upsetting it. It will be seen that as the lever, H, is brought into the position shown in the dotted lines in the drawing, the roller,

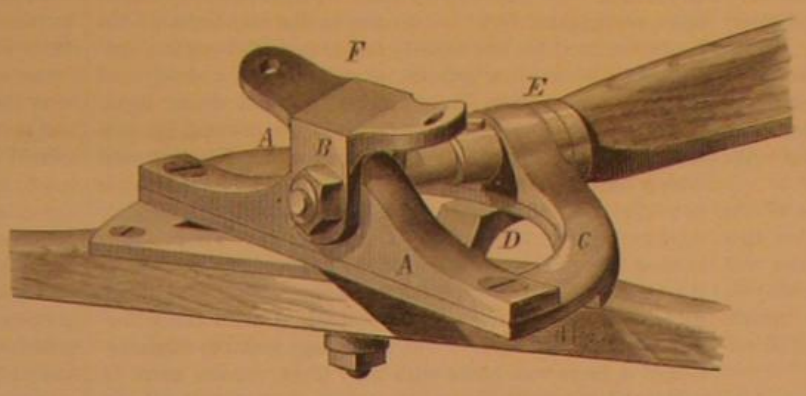


g, draws constantly nearer the fulcrum of the said lever, thereby increasing its advantage over the lever, G, which, by the form of its cam, works against the block, F, with a slightly-decreasing efficiency; but this loss is more than compensated by the advantage gained in the lever, H.

IMPROVED RUNNING GEAR FOR WAGONS.

The improved running gear illustrated herewith is so constructed that either of the wheels may rise above or sink below a level in passing over obstructions or depressions without straining the gearing or body.

The rear end of the reach is secured to the rear axle. The forward portion is rounded off, passes through the head block, A, and has a nut, B, screwed upon its forward end. Said portion of the reach also passes through an eye formed upon the upper circle, C, of the fifth wheel, the forward or straight part of which is bolted to the head block, A. The lower circle is bolted, as shown, to the forward axle. The head of the king bolt is imbedded in the lower side of the head block. The brace, D, is curved upward and rearward so as to pass beneath and serve as a guide and seat for the lower circle of the fifth wheel. Its upper end is bent upward and has an eye to receive the reach. A collar, E, on the reach rests against the forward side of the eye of the upper fifth wheel circle, to relieve the nut, B, from having to sustain all the draught. The springs of the body are attached to the saddle, F, and through lugs on the latter passes the end of the reach. The rear lug has a square hole formed through it to receive a square portion of the reach, so that the saddle is thus held parallel with the rear axle. The wagon body and gearing is thus kept from being strained or twisted by the upward or downward movement of the wheels.



ATWOOD'S RUNNING GEAR FOR WAGONS.

Patented through the Scientific American Patent Agency May 22, 1877. For further information address the inventor, Mr. Moses Atwood, New Sharon, Mahaska county, Iowa.

A Tin-Clad Catfish.

A boy, while fishing in Lake Butts des Morte the other day, felt a nibble, and, drawing his hook toward the shore, observed a half-gallon fruit can trailing on the bottom. Having secured the vessel, he was greatly surprised to find that a large catfish had taken up his abode therein and remained until his increased dimensions did not admit of egress. He had evidently flopped around in his tin parlor until a hole was made in the rust-eaten bottom, through which his tail protruded. In this condition the catfish had power to navigate from one place to another, and must have been regarded by his aquatic neighbors as a kind of iron-clad monitor.—*Menasha (Wis.) Press.*

ANGLE IRON BENDING MACHINE.

We illustrate one of several machines recently constructed by Messrs. Fielding and Platt, of Gloucester, England, for the Stephenson Boiler and Forge Company, Failsworth, Manchester. It is, says *Engineering*, adapted especially for bending angle irons for the rings of boilers 8 feet diameter, and consists of a large circular cast iron table, to one side of which the bending mechanism is attached. As will be seen from the engraving, there are one large and three small vertical rolls. The larger one revolves upon a fixed spindle, while the spindle of the others can be traversed by means of screws. The angle iron to be bent is gripped between the fixed and the middle traversing roll, and the two outer ones are then moved forward simultaneously to bend the bar to the curves required. One of the large handwheels is used for moving the griping roller, and the other for traversing the bending rolls, the screws employed for this being geared together. The two gripping rolls are driven by the gearing shown in the drawing, the moving roll being connected to the gearing by universal clutches, which allow a free motion to be given to the sliding bearings. The two bending rolls are of course free on the spindles, and are not driven. For carrying the angle irons upon the table, rollers may be recessed into its face.

Disinfecting the Air in Hot Weather.

M. Boschau has devised a method of disinfection based on the continuous and economical production of ozone by means of manganese dioxide, which in view of the present warm season, is of timely interest. Ordinary light brown wrapping paper is thinly covered with size, and on the latter the pulverized dioxide is sifted, so that it forms an adherent layer. It is merely necessary to hang the sheets thus prepared in the apartment to be disinfected or aerated. M. Boschau states that he lined a trunk with paper thus prepared, and placed therein some old cheese and strong radishes, which he left in the receptacle for a fortnight. At the end of that period the materials were removed and the lid of the trunk quickly shut. Fifteen minutes afterwards, on opening the trunk, not the slightest odor was perceptible. the ozone given off by the dioxide having completely disinfected the carbonic and butyric acids produced. The inventor proposes to manufacture wall paper, prepared in an analogous manner for use in schools, hospitals, etc.

Strange Accident.

An extraordinary accident occurred recently at a small shop in Fleet street, where American "crullers" and iced drinks are sold. Some person recommended to one of the young ladies employed in this shop the use of nitric acid and quicksilver for cleaning silver. The person thus advised purchased the prescription, telling the chemist, it is alleged, for what purpose she intended it. Whether this was so or not, negligence would seem to have been shown in giving to an inexperienced person two such dangerous agents without due warning of the consequences of their admixture. The poor girl proceeded to mix what she had obtained directly she returned to her place of occupation, with the result of a violent explosion, which, it is feared, has destroyed her sight. —*London Echo.*

Fusing Nickel and Cobalt.

M. C. Winckler announces in *Dingler's Journal* that he has succeeded in fusing nickel and cobalt in ingots of from two to five kilos, by using refractory crucibles, maintaining a very high temperature, keeping carbon and silica from contact with the melted metal, and by carefully excluding the oxygen of the atmosphere during the progress of the casting.

Oil in California.

The *Alta* says that, in Southern California, one well is already yielding 25 barrels per day, and only 180 feet depth has been bored. Pipe lines are already projected and California anticipates a repetition of the Pennsylvania oil fever.

Competitive Trials of Steam Fire Engines in Sweden.

These trials commenced near the Southwater Tower of the Government Railway Station. Shand, Mason & Co.'s engine, No. 4, which was first tested, obtained steam in 4 minutes and 30 seconds; produced 100 lbs. pressure in 7:50, and filled a tank holding 6,500 tons in the short space of 4 minutes. Merryweather's double cylinder engine produced steam in 4:30 and obtained 100 lbs. pressure in 12:10. The test of this engine in filling the tank was now interrupted, as were all other operations of the respective engines exhibited, by order of the Chief of the Fire Brigade, because of the danger apprehended of some adjacent wooden houses and sheds being ignited by the sparks ejected from the engine funnels, it blowing very hard just at that time. All the engines, eight in number, were then removed to the south side of the castle, and set to work again, in order to compete for rapidity in producing steam, equality and constancy of pressure, as well as for vertical height. The top of the staff on the roof of the castle being the highest adjacent point, and is 150 feet above the level of the water. Bedmoe's engine (Liege), which took the lead in the trial, produced steam in 8 minutes, and attained 105 lbs. pressure in 13:5. Next came an American engine (Messrs. Nichols & Co., Vermont), producing steam in 4:30 and 100 lbs. pressure in 10:30. Merryweather's single horizontal obtained steam in 7 minutes and reached 100 lbs. pressure in 10:50. Shand & Mason's large engine then produced 100 lbs. steam pressure in the shortest space of time, being 7:30 against 7:50 in the morning. Merryweather's large engine obtained this time 100 lbs. pressure in 11:40 against 12:10 in the morning. A very interesting competition now took place between Shand & Mason's and Merryweather's two largest engines. Shand & Mason used in this trial a $1\frac{5}{16}$ nozzle, and Merryweather one of $1\frac{5}{8}$ inch. The former, however, threw a higher jet, with, of course, a greater volume of water. —*Nerikes Allehanda Orebro District Journal.*

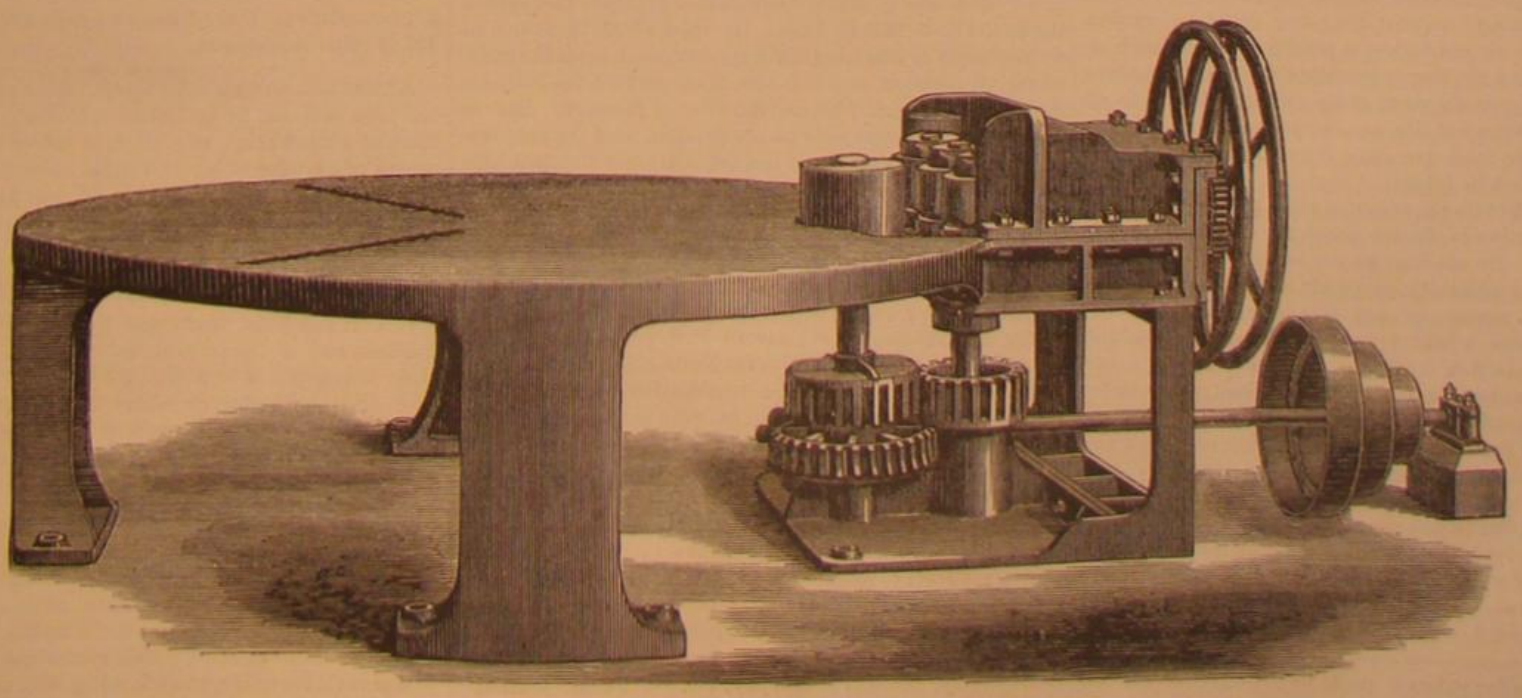
Rain Power.

A writer in *Cornhill Magazine* says that the amount of heat required to vaporize a quantity of water which would cover an area of 100 square miles to a depth of 1 inch, would be equal to the heat which would be produced by the combustion of half a million tons of coal, and that the amount of energy of which this consumption of heat would be the equivalent corresponds to that which would be required to raise a weight of upwards of 1,000 millions tons 1 mile high. To evaporate the annual rainfall on New York State alone in a year would require about five times the annual coal output of the United States.

Large Telescopes.

Clark & Son, of Cambridge, Mass., are making a telescope fifteen feet long with an object glass of eleven inches in diameter, for the Government Observatory at Lisbon, to cost $6,000, and be used for photographing the sun. Princeton College is having a $4,000 one made with a nine inch glass for astronomical excursions, and talks of getting a much larger one. The Clarks are also to make a gigantic one for Yale College, but it will take several years' work and cost some $50,000; the flint for the object glass, which has already been bought in France, cost $6,000.

IT is stated that a meteoric stone fell, on the 19th of June, at Bowling Green, Ky., within ten or fifteen feet of a little boy at work on a farm, striking a tree with a report like that of a small cannon. The report states that it weighs about a pound and a half, and resembles a fragment of grindstone, but is much harder and heavier.



ANGLE IRON BENDING MACHINE.

SCIENCE AND SCHOOLS.

We have before us an abstract of a paper entitled the "Intervention of Physicians in Education," also a set of resolutions of the New York Academy of Sciences on the subject of "Physiological Education." The author of the essay, and likewise the member of the Academy at whose instance the committee which brought in the resolutions referred to was appointed, is Dr. Edward Seguin, of this city.

In his paper Dr. Seguin advocates the active intervention of the physician in the training of children, and he thinks that such intervention should result in the establishment of open air garden schools, and also in the physician becoming the "keeper of the balance of the vital forces of the children." "Vital force" is a rather unscientific term, for as indicating a force inherent in or wholly peculiar to living matter many of our foremost thinkers have entirely abandoned it. What Dr. Seguin doubtless means is that the physician should be called upon to study the mental and physical peculiarities of children and so determine for each child its study potential —a factor belonging possibly to the class of personal equations which enter into the astronomer's labors.

In the resolutions above noted, we get a glimpse of the detail of the proposed garden school in the suggestion that the public parks of the city be devoted to that purpose, and in order that the educational facilities of the parks may be extended to adults as well, it is proposed that these breathing places be stocked with "plants of economic and scientific interest."

We quote these views both to dissent from them and to use them as a convenient example of those mistaken efforts toward scientific progress which rather retard than promote real advancement. It is indubitably true that there exists abundant room for hygienic improvement in our schools. Buildings in many cases are unsuited for their purpose, ventilation is bad, the children are too frequently kept too closely confined, and the pernicious system of requiring studies to be accomplished outside of school hours still further trenches on that period of relaxation which is necessary for the maintenance of proper health in the growing and immature body. We mean to say that there is no lack of abuses in the modern school room, and perhaps to the physicians more than to any one else, the public looks for the amelioration. Hence when physicians proceed to advocate views as little defensible as those of Dr. Seguin, the circumstance is something to be regretted.

The idea of open air schools in the abstract is well enough; but when it comes to be applied to a great city, Dr. Seguin sees no way of so doing except by taking the public parks. A child is quite competent to express its opinion on a scheme which looks to the turning of its only play ground into a school room, and it is hardly necessary to say what that opinion would be. The trouble in this, and in all large cities, is that there are not half parks enough, that the majority of children find their play ground is the filth and mire of the streets, and that the very need of more such places where a breath of air not reeking with the effluvia of a dense population can be obtained, has much to do with the large death rate which obtains among the children every summer. Dr. Seguin might have read in recent daily journals column after column of complaints because one of the least frequented parks in the city was closed an hour or two too soon in the evening, and at the same time he might have discovered that not merely to children, but to the whole working community, nothing would be more distasteful than the conversion of even the smallest park into school rooms or resorts for botanically inclined scientists.

The suggestion relative to study of children by physicians is equally impracticable. In round numbers there are about 160,000 school children in this city, and 1,550 physicians, or say one physician to every 100 children. The number of physicians in New York compared to the total population is anything below the average ratio, as to every physician there are some 700 people. From this can be inferred about the average worth of a physician's practice in this city, and the consequent cost to the people of the extra burden imposed upon the profession by critical examination of school children—supposing even that the latter could be successfully done. We do not believe it possible that any such accurate records of a shifting population of 160,000 children could be kept, especially when these children belong to all grades and conditions of life, exist under an infinite variety of circumstances, and are constantly departing as their places are supplied by others.

Dr. Seguin falls into the common error of progessive reformers, of wanting to do too much for the people and in the wrong way. No one who knows him will for an instant doubt either his philanthropy or his ability, and therefore we all the more regret any such wanderings into devious paths as the above would indicate. We cannot establish academic groves in New York just yet, nor is Young America, precocious as he is, ready to give up ball and hoop for "plants of scientific and economic interest." Urge the school boards to protect their buildings properly from fire and the consequences of panic, doctor; see that they give the children honest air to breathe, and not dilute carbonic acid; fix the studies to suit the average minds of the youngsters, and don't load them with a library of books to carry home and study nights when they should be asleep. This will be good work. We are not yet sufficiently advanced for anything beyond.

A GOOD dryer for paints is made by grinding or dissolving a small quantity of sugar of lead in linseed oil.

Experiment with the Jablochkoff Electric Candle.

The recent experiments with the Jablochkoff electric candle at the West India docks, Limehouse, London, were completely successful. A large tent had been erected covering an oblong space of 110 feet by 80 feet, in which four ordinary lamp-posts had been set up, each having a simple spherical globe of opal glass surrounding the disk in which the kaolin and carbon candles were fixed. The electricity was generated by a steam engine of two and a half horse power. When the connecting wires were placed in circuit, the four candles flashed out a brilliantly white light that was momentarily blinding, notwithstanding the opal globes that materially veiled the intensity of the glare. For some seconds there were noticeable flashes of intermittently bright light, owing possibly to deviations in the resistance of the kaolin before it became equally fused, then the candles continued to burn for a quarter of an hour with a steady and intensely white glow, like no other artificial white light. At a distance of twenty or thirty feet from the opal lamp, it was possible to decipher the minutest notes faintly traced with a hard-pointed pencil. When sixteen gas jets with powerful reflectors were lighted, and the electric candles were extinguished, the effect was marvelous. They seemed to shed but the faintest glimmer around, and it appeared as if yellow glass had been placed in the lamps, so "jaundiced" was the sickly hue they cast in comparison with the whiteness of the other light. The next stage was the illumination of a large warehouse with only three candles burnt in ordinary lamps with rough tin reflectors, and without any opal shades to soften the light. The glow of the incandescent kaolin was in this case so fierce that the people turned away from it like owls blinded by sunlight. The illumination, however, was perfect. Except where black shadows fell, sharply defined, from interposing beams and pillars, every corner of the warehouse was penetrated by light. One gentleman had brought with him a card of patterns in different textures and every conceivable tint. Placed where the rays from one of the lamps fell directly on them, the greens, blues, yellows, reds, purples, and even the most delicate tint of straw color, were as clearly distinguishable as in daylight. After this there was an experiment intended to show the possibility of unloading ships at night. One candle was placed in a common street lamp on the wharf, and one fixed in a handlamp, with a sufficient length of insulated wire to enable it to be carried about the various parts of the ship. On deck, in the hold, and from end to end of the vessel, this lamp was borne without the light flickering for a second. Wherever it was placed, every object for yards round about was clearly defined. At the same time the light on the wharf was so powerful and widely diffused that the labor of unloading the ship might have been carried on without difficulty.

Statues to Scientific Men.

An unusual interest is manifested in France at the present in regard to honoring her distinguished men of science by erecting statues to their memory. A statue to Arago is being erected at Perpignan, in the department of Orientales Pyrenees. Another to Nicephore Niepee, a name well known in connection with improvements in photography, will be erected at Chalons-sur-Saone, his native place, by public subscription, at the instance of the Municipal Council of the city. It is also stated that a public subscription will be opened at Lyons on behalf of Ampere, the inventor of the electro-magnet, and the precursor of Faraday in the invention of the inductive electricity. Ampere was born in that city in 1775, and his father was guillotined there on the Place des Terraux for having been active in the great royalist rebellion against the Convention, which ended in the famous siege of Lyons and his capture by Dubois-Crance.

Is there a Resisting Medium in Space?

European astronomers are still wrestling with the problem. Is there a resisting medium in space? first suggested by the acceleration of Encke's Comet. Dr. Von Asten has just given the results of his investigation of eighteen passages of the comet from 1818 to 1875. He thinks that there can be no hesitation in affirming that a resisting medium is the cause of the acceleration, and that the dense part of the medium does not extend much beyond the orbit of Mercury. But in 1871, there happened to be no acceleration, and the only explanation of this Von Asten can offer is that a violent disturbance took place about the middle of June, 1869, and that this might have been caused by a collision with one of the undiscovered minor planets, whose orbits lie between Mars and Jupiter.

Exhibition of the Anthropological Society of Paris.

The Anthropological Society of Paris propose to give an exhibition in connection with the Paris Exhibition of 1878. The society has appointed a commission comprising the leading anthropologists of France, who have issued a programme which promises to be the most interesting and valuable exhibition of this kind ever displayed. The following are the classes under which the exhibition will be arranged: 1. Crania and bones, mummies and specimens relating to the comparative anatomy of the human race. 2. Instruments, methods of education. 3. Prehistoric and ethnological collections. 4. Photographs, paintings, and drawings, sculpture and modeling. 5. Geographical maps and tables relating to ethnology, prehistoric archæology, linguistic, demography, medical geography, etc. 6. Books, journals, brochures.

Danger in Vinegar.

There are more kinds of so-called vinegar in the market than brands of family flour. The New York *Tribune* thus alludes to one of them: The Board of Health of the District of Columbia has condemned five car loads of vinegar sent there from Chicago, on the ground that it is not a genuine article, and is injurious to health. An analysis of the so-called vinegar has been made. It appears, according to the report of the Board of Health, that the vinegar contains $54\frac{54}{100}$ grains per gallon of anhydrous sulphuric acid, combined with lime to form a sulphate of lime equivalent to $117\frac{36}{100}$ grains of gypsum per gallon, and besides that, 5 grains of free sulphuric acid per gallon. The Board also report that this sample was taken from an invoice of more than 1,000 barrels brought there to be sold as vinegar, and that it is likely to find a ready sale on account of its low price. The report concludes as follows: "When we think that oil of vitriol (sulphuric acid) can be bought at five cents per pound, and that a pound of said acid would render a barrel of fluid as acid as the strongest vinegar, the wonder will cease that it is sold cheap. This, therefore, is a fraud upon commerce, and a dangerous substitute for vinegar." The fraud and danger are more general than the great mass of people will readily believe. It is asserted that probably one half the vinegar sold at city groceries is a rank poison, with either sulphuric or other objectionable acids for its base, from which the acetic principle is evolved, the same as in the manufacture of aromatic vinegar or the acetates used in calico printing. Acetic acid is present in all vinegars, although they seldom contain more than five per cent of the absolute acid. Their color, flavor, and value depend materially upon the ingredients from which they are made. In England, honest vinegars are usually made of malt; in France, of grapes; in Germany, of grapes, beetroot, or potatoes; in this country, of apples and grapes.

Asparagus Paper.

A man of science, writing to the *Patrie*, explains what is the principal use to which the bundles of white stalks of asparagus, from which the tips have been bitten, may be put. They may be made into paper, and that not ordinary brown paper, or even foolscap, but letter paper of the finest description. It appears that in a few favored places there are manufactories where the asparagus ends are used in this way, and where the careful housekeeper hoards up the scraps with a diligence unknown elsewhere. But the work of collecting them is an up-hill task as yet, and it will be years before, in the natural order of things, the practice of saving them and packing them off to such factories for sale is at all generally adopted.

History of the Alphabet.

Rev. Isaac Taylor has read a paper before the Victoria Institute, London, on De Rouge's investigations of the history of the alphabet—the oldest achievement of human ingenuity. It passed through three stages—from pictures of things (ideograms) to symbols of words and syllables (phonograms) and lastly into letters. All the alphabets could be traced by means of the Moabite stone to the Egyptian hieroglyphics, and the successive changes were shown to be, in a great measure, owing to the necessities produced by the nature of the writing material, unwillingness to devote much time to the accurate reproduction of original forms, and the requirements of legibility.

Population of Russia and Turkey.

In a paper read recently by Mr. E. G. Ravenstein before the Statistical Society, London, on the populations of Russia and Turkey, he stated some facts of especial interest at present. Russia has a population of 84,584,482, while Turkey has only 25,286,868. The increase of the former is 1·1 per cent per annum, the Jews being the most prolific of the inhabitants; but in Turkey the author believes that the Turks proper do not increase at all, owing to the vicious habits of the women and the losses entailed in defending the empire. In Russia there are 100 Russians to every 50 of other nationalities, and 100 Christians to every 16 Mohammedans and pagans, while in Turkey there are only 100 Turks to every 197 of other inhabitants.

A VERY sensitive metallic thermometer on a new principle has been invented by an Italian optician in Paris. The dilations of a small sheet of platinized silver are amplified by means of a system of levers, and the motion is communicated to a needle on a dial, on which degrees are marked. The motion of the needle is almost instantaneous. The apparatus has been tested in the Ville de Paris, a new balloon sent up on June 3 at Paris.

CULTIVATE frogs, toads, and lizards. Put them in your gardens, and as the evening approaches they will hop from their hiding-places and snuggle down in some convenient spot near the gutter, or where they know their food will come plenty. The ants, roaches, mosquitoes, etc., they consume in a night is marvellous, and thus they keep down the insect pests.

THE Societies of Natural History, Geography, and Anthropology, in Madrid, have appointed a commission for the purpose of forming a Science Association, similar to those in England and the United States, to hold annual meetings in different parts of the kingdom for the investigation of scientific matters. This movement indicates a revolution in that country, more hopeful than any heretofore undertaken.

SETTING WORK AFTER CASEHARDENING.

"I make," says a correspondent, "a great many quadrants similar to the links of locomotives, and I find that the casehardening process causes the links to warp and the sliding dies to swell. How can I readjust them to a proper fit? The difficulty is that the casehardening stiffens the links, and while a certain amount of strain will open or close them, but a very little more will alter them too much. Is there any way of knowing intelligently how much strain I require in any individual case?" Our correspondent has asked a very practical and somewhat interesting question which we take pleasure in answering. In the first place, such dies always swell in hardening, and it is proper to make, during the fitting process, an allowance whose quantity must be determined by the shape and size of the die, and this experience alone can determine for each particular case. In the second place, there should be placed in slot of the link several neatly fitted pieces of sheet iron, to prevent it from closing. Then the links should be so packed in the hardening box, that the weight of the upper ones will not be likely to warp the lower ones when they are red hot. The links when taken from the box should be dipped vertically, and not thrown carelessly into the water. Notwithstanding these precautions, however, there will take place a certain amount of alteration of form, and the following method of readjusting will be found to be very efficient: If the slot is too wide, the link may be closed by iron screw clamps. If it has opened at one end only, the die should be placed in the link at the other end while the open end is closed. The closing process is very easily performed by clamping, especially when a bolt and nut is used in conjunction with the die to support the slot, in those parts that do not require closing. The closing is generally made too much, because it is less difficult to open the slot true than to close it true. The amount of opening can be more freely adjusted than that of closure, the method being as follows: Make two keys, planed on the edges to an equal taper, and of such a width that the two small ends placed edgeways together and contacting a distance about equal to twice the thickness of the link, will measure from outside edge to outside edge of the two, an amount equal to the width of the slot. The length of the keys should be about two and a half to three times the thickness of the link, and the amount of the taper should be about one half inch per foot. Take one of these keys and place it with a planed edge on the face of the slot, the key laying horizontally and projecting equally through each side of the slot, the key head being, for example, on the left hand. Take a scriber and make a mark on the face of the key, which will denote how far that end of the key projects through the slot. Take the other key and oil both of its planed edges, and insert in the slot above the other key, that is to say, so that one of its edges will contact with the edge of the key already inserted, while its other edge will meet the inside of the slot, the head of one key being on one side and the head of the other key being on the other side of the link or quadrant. Now take a hammer and drive in the key last inserted as far as the judgment, and a pair of callipers applied to the slot, indicate as sufficient to open the link to the required amount. Here, however, we may remark, that the keys being inverted, and of the same taper, the outside edges are parallel and the link is therefore being opened true, which would not be ensured were a bolt and nut used instead of the keys. Furthermore, the key that is oiled is the one that is driven. The key with the scribe mark is dry on its edge and meets the face of the slot. The result is that the driven one will drive through the slot without moving the position of the other having the scribed mark, which will keep even with the link face. Having driven in the key as directed, we take a scriber and make on the face of the driven key, and even with the face of the link, a mark which will serve to show how far the key was driven in. We may now drive the oiled key out again and test if the link slot is opened sufficiently; if not, place the first key as before, with the scribe mark even with the face of the slot, then insert the oiled key driving it a little further than before, the scribed line being a guide as to how far to drive it. Before taking it out again, we scribe a new line to indicate how far it is now driven. The keys may be removed, the testing continued, and the processes continued until completed. It will be observed that the keys thus employed, form expanding parallel pieces having the power of the wedge, and that the lines marked form a gage to work by. The gage line is especially useful, for the reason that the link will spring to a considerable degree without taking a permanent set. The keys will act just as well at the ends of the slot as in the middle, and the outside of the link may be clamped at any point not requiring to be opened.

The Ape that Most Resembles Man.

Professor Garrod lately held a reception in the Monkey House at Zoölogical Gardens, and discoursed to the people about the anthropoid apes. The professor made it plain that the anthropoids are the simial aristocracy, even if we may not more accurately call them our poor human relations. As prosector of the Zoölogical Society, the professor stated that he had dissected seventy apes out of the anthropoidal class, and one of them exhibited the vermiform appendage of the cœcum, or blind gut, which is characteristic of man. But the anthropoids have it quite humanly developed. The hands and feet of an orang recently dead were exhibited along with those of a man, and exhibited the same structure. The manners and customs of gorillas were described from authentic observations, and their domestic arrangements, their sleeping hammocks, and use of stones in cracking nuts increased the impression made that this animal is very human-like, indeed. Professor Garrod showed that the structural resemblances between the anthropoid apes and man are so close that the reason for the mental and moral differences remains still an unsolved problem. Perhaps the most striking and important portion of his discussion was that in which he proved that the vocal organs of man are present also in the anthropoid ape. The ape does not converse, and yet the difference between his vocal apparatus and that of man is so infinitesimal as to defy observation. It is to this point, however, that physiological investigation must now be particularly directed.

Professor Huxley declares that, to his mind, the only thing that promises to explain the mental difference between the anthropoid ape and man is this phenomenon of language. This he said in a lecture at the Royal College of surgeons. Language implies consultation, comparison of experience—necessarily embodies itself in the written form, becomes the storehouse of facts, results in inferences, and in the wisdom which can control and modify nature where the dumb creature is controlled and modified by nature. By the power of intelligent and purposed selection and combination so secured by the ability to talk, the animal so endowed might gradually build up a better brain on the same structure as that possessed by an animal that could not talk, and so could not obtain the complete coöperation of his fellows for the work of improvement. If it should be ultimately determined by physiologists that there is absolutely no difference between the vocal organs of the anthropoid and man, refuge would have to be taken in the hypothesis that there is some point in the animal brain corresponding to the vocal power, which does not exactly rhyme with the latter in the anthropoid, but does rhyme with it in the man.—*M. D. Conway's London Letter to the Cincinnati Commercial.*

Argentiferous Mud.

In Wasco county, Oregon, there is a flat thickly studded with springs of a peculiar character, that throw out mud, which has overflowed a considerable area. Some months ago it was reported that this mud had been discovered to be argentiferous and very rich, some specimens assaying over $2,000 to the ton. An effort was made to organize a company in this city to work the mud springs, but the enterprise collapsed in consequence of a suspicion raised that the mud had been "salted," and the memorable Arizona diamond field swindle was too fresh in recollection for the successful prosecution of another fraud in the same line. Professor Thomas Price analyzed samples submitted, and reported that he had discovered unmistakable evidence of "salting," the microscope showing filings, crystals, and free gold, which he had no hesitation in declaring had been mixed in with the mud with the manifest design of instituting a great swindle. Professor H. G. Hanks also examined specimens, but while he was inclined to suspect fraud, he was unable to determine positively whether the argentiferous mud was an artificial or natural production. Professor Hanks now intimates that the flow of the Oregon mud springs is in reality heavily impregnated with silver, and this result he announced in a paper read before the California State Geological Society. The existence of springs yielding soft mud, charged with free silver, says Professor Hanks, is new to science, and scientific men, both here and at the East, who examined specimens, pronounced them fictitious without hesitation. The specimens latterly examined by Professor Hanks, he says, were very rich, and silver was discovered in a free state. By simple washing the silver could be wholly separated, and when then examined the microscope failed to reveal the source of the precious metal. Had it been filings, a single glance would have sufficed to detect the fact. Had the silver been precipitated from solution by copper it would have been crystallized. An amalgam of silver and mercury would have yielded a sublimate if strongly heated in a glass tube closed at one end. Such an amalgam introduced into the wet mud, and the whole heated sufficiently to have volatilized the mercury, would have left the substance in a hard baked state, which could not again have been reduced to the state in which it reached this city. From these conclusions, if the silver had been introduced for fraudulent purposes, the substance was very remarkable, from the fact that some process had been employed not easily understood. Professor Hanks finally obtained the address of a gentleman, Richard Hurley, residing in the vicinity of the wonderful springs in Wasco county, and applied to him for information. In reply to Professor Hanks, Mr. Hurley writes: "There is no mistake as to this mud containing silver. I have assayed over 100 samples which contained silver, some as high as $2,300 to the ton. The samples I obtained from the spring myself. I think the weather has considerable to do with the mud containing silver. I obtain the best results when the weather is warm. Sometimes in one of the larger springs, when the weather is cold, the mud will be of a yellow color, showing no silver, but when the day is warm the mud is blackish blue, at least in places, and rich in silver. The springs seem to work more actively in a warm afternoon. Some of them contain a great deal of acid, the bones of animals that fall into them being dissolved in a few months. There are old wells which assay from $5 to $1,200 to the ton. One assay I made from the flat, half a mile from any spring, assayed $1,200 to the ton. There is a great deal of salt, almost pure, all over the spring flat. There are between 100 and 200 quartz leads discovered, running in two directions close to the spring. I find silver in several of them, all the way from a few dollars to $100 to the ton. Some of these leads run through the springs, at least they point in that direction. The altitude of this place is between 4,000 and 5,000 feet."

Professor Hanks also refers in his paper to the recent discovery of a peculiar silver-bearing deposit located in Southwestern Utah. It occurs in the "Maud Mine,' six miles from Leeds. Some assays as high as $700 per ton have been made. Instead of being sandstone, as supposed, Professor Hanks found the deposit to be sedimentary, but closely resembling the Oregon mud. Under the microscope it has all the appearance of that strange substance. The Oregon mud, if allowed to dry in large quantities, would soon form a similar substance to the Utah mineral, in appearance at least. The silver is in the state of chloride, and is seen under the microscope both amorphous and in crystals. An analysis of the two minerals will be interesting, and may throw some new light on the subject. It is possible that a study of these deposits may contribute much to our knowledge of the formation of metaliferous veins.—*San Francisco Examiner.*

Trial of a New Brake.

The express train, the "Flying Scotchman," which leaves King's Cross, London, for Newcastle, 4:05 P.M., was lately fitted up for the first time with a continuous vacuum brake. The apparatus which has been fitted on the "Flying Scotchman" is Smith's vacuum brake, the general construction of which is simple. The vacuum is obtained by a steam ejector. The steam jet is annular, 2 inches in diameter, and $\frac{1}{16}$ of an inch wide. India rubber hosepipes connect the brakes from end to end of the train with the ejector. Under each carriage is placed an apparatus variously known as a sack, an accordion, a melodion, and a bellows. It is really a canvas bag, protected by an india rubber covering, about 15 inches diameter and 18 inches long, cylindrical in cross section, fitted with iron heads, and prevented from collapsing by iron rings of round section, about ¼ inch in diameter, "cured" in the thickness of the rubber; one end or head of this bag is secured to the framing, and the other to a simple system of bars connected with the brake blocks. When the steam passes through the ejector a partial vacuum of 14 to 18 inches of mercury is formed in the bags, and they tend to collapse under the pressure of the atmosphere. But the motion is prevented, by the rings just referred to, in any direction but one, and the sacks shut up like a concertina, and in doing so apply the brakes. With the exception of the leading wheels of the engine and the wheels of the royal mail van, the train throughout was fitted with Smith's brake, each wheel having double brake blocks attached.

How Poisons are Spread.

Mr. G. Owen Rees, Consulting Physician to Guy's Hospital, London, has called public attention to some unexpected sources of arsenical poisoning. The green calico lining of bed curtains has been found to have produced, for months, severe symptoms, which were treated as those of natural disease, without benefit to the patients. When the curtains were removed the patients at once recovered their health. The beautiful pale-green muslin, largely used for ladies' dresses, has been found to contain not less than 60 grains of the arsenical compound known as Scheele's green in every square yard. He suggests that, in order to prevent much of the nausea, vomiting, headache, inflammation of the eyes, etc., from which so many suffer, there be a prohibition of the manufacture of such deleterious fabrics. Red, scarlet, and mauve-colored fabrics are not always free from arsenic. He adds that the agitation of skirts in dancing discharges arsenical poison, which probably causes some of the pallor and languor almost always wholly attributed to ill-ventilated and crowded rooms, and to bad champagne.

A Sandstorm in Rome.

June 22, a curious shower of sand and mud, coming from the south, fell in Rome, which seems to be regarded as due to sand brought in a dust-storm from the great desert in Africa, being mixed with the pollen of some vegetable, and held in solution by the cloud which carried it. An artist, writing to the *Times*, says that yellow spots, of about a twentieth of an inch in diameter, were made on the paper on which he was sketching, and also—though the color varied from yellow to white—fine drops of the same diameter fell all about the neighborhood of Rome. The cloud which brought it, though giving out little or no rain, turned the sun at 4 P. M. into the semblance of "a pale moon of greenish tint." Similar phenomena were no doubt mistaken for a rain of blood by the Romans, and regarded as prodigies, ominous of coming evil.—*Magfair.*

Carbonic Oxide in Tobacco Smoke.

M. P. Guyot calls attention in *Science pour tous* to a recent note of M. Grehaut, in which the author states that tobacco smoke contains carbonic oxide, in such quantities that a dog after being compelled by a special apparatus to smoke four cigars, was killed by the poisonous gas. M. Guyot gives a number of analyses in support of the above statement, and shows that in 100 volumes of smoke there exists ·165 volumes of carbonic oxide. If a pipe be used having a smoke chamber this proportion increases to ·18 volume, and if it has a smoke filter made of cotton impregnated with an alkali, the proportion is still further augmented to 1·695 per cent.

GRAVES' IMPROVED OIL CAN.

The invention herewith illustrated is an improved case for packing oil cans for transportation, the construction being such that the can is readily inserted, and when in place may be tilted in order to draw off its contents. Fig. 1 represents the case closed. Fig. 2 shows how the can is supported when the case closed. Fig. 2 shows how the can is being poured out. The case is made in two sections. The oil is being poured out. The case is made in two sections. The inner section, A, is attached by top cross pieces to two sides and the bottom of the can, while the outer section, B, covers the remaining sides and has a connecting second bottom. The lid, C, which has an aperture in it through which the can handle projects for convenience in carriage, and which also serves to hold the sides of the outer section firmly to the can, completes the device.

Fig 1.

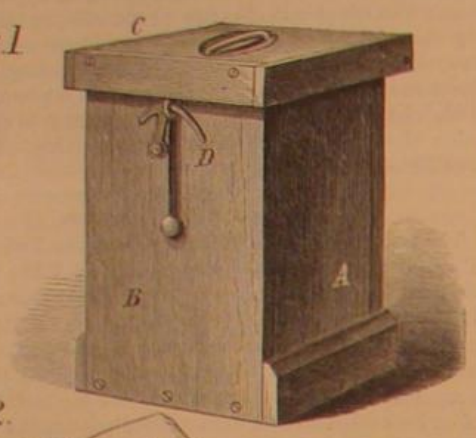
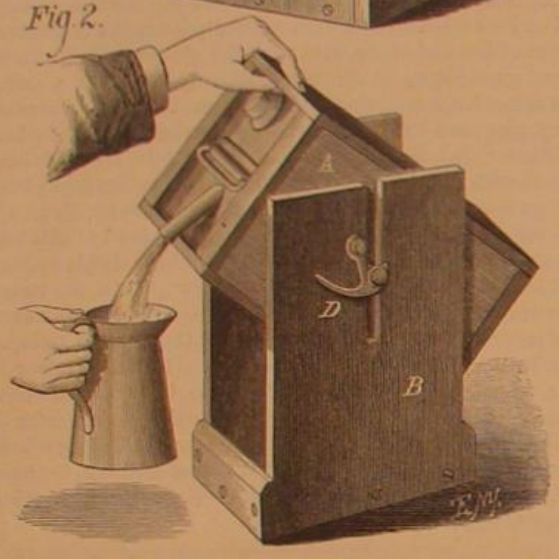


Fig 2.

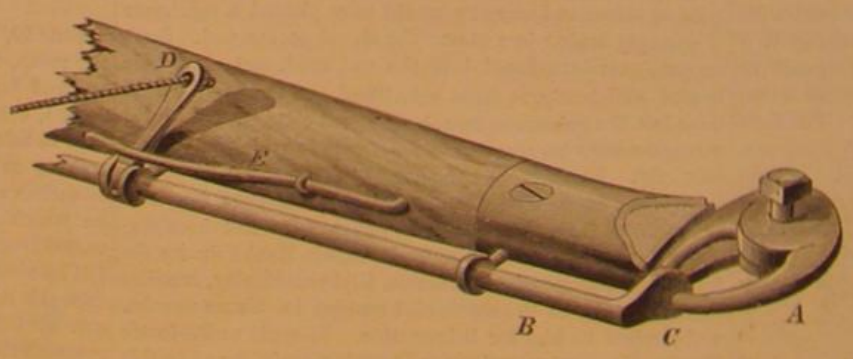


The lid is locked to the outer section, B, by means of double pivot hooks, D, passing through suitable staples, as shown in Fig. 1. Slots are made in said outer section into which enter trunnions or side pivots secured to the can. When the latter is lifted with the inner section after the lid has been removed, the hooks, D, drop, by their own weight, below the trunnions, and support the can at such a height above the bottom of the outer section that it may be easily tilted for drawing the oil from the spout.

Patented through the Scientific American Patent Agency, by John Graves, May 22, 1877. For further particulars address Frank Miller & Son, 349 and 351 West 26 street, New York city.

HORSE DETACHER.

The annexed engraving represents a novel and simple apparatus for the immediate freeing of horses from a vehicle by an occupant of the latter. Upon the ends of the whiffletree are formed lugs in which are pivoted at each end a double hook, A. The ends of this hook are at such a distance apart that the cockeye of the tug may easily be passed between them. B is a rod which works in staples along the rear side of the whiffletree. On its ends are formed heads, C, of such a size as to enter the space between the ends of the hooks, A, and so prevent the tug from slipping off. To the center of the rod is attached an arm, D, which is held down upon the whiffletree by a spring, E; to the arm a cord is attached. The cockeye of the tug is slipped over the outer arm of the hook, A, and the head of the rod, B, is turned into the space between the hooks. Should it become necessary to detach the horses, the driver pulls upon the cord, which turns the rod, and raises its head out of the space between the points of the double hook. The draught strain then turns the hook forward and pulls the tug therefrom, so detaching the horse.



BARKER'S HORSE DETACHER.

Patented through the Scientific American Patent Agency August 8, 1876. For further particulars address the inventor, Mr. Amos M. Barker, Olin, Jones county, Iowa.

Economical Paint.

Skim milk, 2 quarts; fresh slacked lime, 8 ounces; linseed oil, 6 ounces; white Burgundy pitch, 2 ounces; Spanish white, 3 pounds. The lime to be slacked in water, exposed to the air, and mixed in one fourth the milk. Dissolve the pitch in the oil and add a little at a time. Then add the rest of the milk and the Spanish white.

A Japanese Print Shop.

The shops scattered through Tokio, where cheap prints are sold, attract attention from the gay colors of the pictures, strung on the lines for public observation, and by the crowd of interested spectators generally clustered before them. The variety of these prints and their artistic merit astonish one. A prominent house, one of the largest in Tokio, has already issued one hundred and thirty sets of pictures, each comprising three engravings, on schemes suggested by the Kagoshima insurrection. The wood cutters, at the best, can earn by industry from seven to ten dollars a month; twenty-five cents a day is good average pay. To cut the more complicated plates requires from a week to ten days. The whole expense of preparing one of these prints, then, including designing, cutting the original plate and the color plates, of which latter there are sometimes upward of twenty required for one picture, inks, etc., is about seven dollars. They sell, on an average, for five cents a set of three pictures. While quite a novelty, however, they maintain a "fancy price," sometimes, where a great hit has been made, going for as much as fifteen cents a set; and, on the other hand, antiquated prints may be bought for a cent a sheet.—*Tokio Times.*

Torpedo Trial at Cleveland.

A series of experiments have been made in Cleveland, Ohio, with what is known as the "Lay Torpedo," an invention of Mr. Lay of Buffalo. The torpedo is cylindrical, with conical ends. The forward cone is calculated to contain one hundred pounds of any explosive substance. The forward section of main cylinder contains a liquid capable of powerful expansion into gas, which is used as the motive power, and is connected with the machinery by a valve operated by electricity, and a pipe. There is also a cable coiled in the same way that harpoon lines are arranged in whaling vessels, which may be any length desired, and which is connected with the shore or a vessel. The torpedo, when launched, is entirely under the control of the operator, who may be stationed on shore or aboard ship. He has a compact battery and key board on which are small switches with which he guides, controls, and explodes the craft by electricity. The secrecy with which the experiments have been made aroused general curiosity, and great crowds gathered on the dock to witness the public trial. The experiment was a splendid success in every particular. There were present a number of distinguished men, conspicuously among whom were the Assistant Chinese Minister, Yung Yuen Poo, and his secretary, a number of naval officers, and visitors from other cities. A stake boat was stationed a half mile from the shore, and when the battery was applied the torpedo started off at a rapid rate, going to the stake boat in three minutes and twenty seconds, and, gracefully rounding the boat, started on her return, which was made in the same time. It is claimed by the owners that this craft will travel twelve miles per hour. The rapidity and precision with which the machine obeyed the operator clearly demonstrated that it is one of the most formidable weapons of naval warfare ever invented.

Iron Cement.

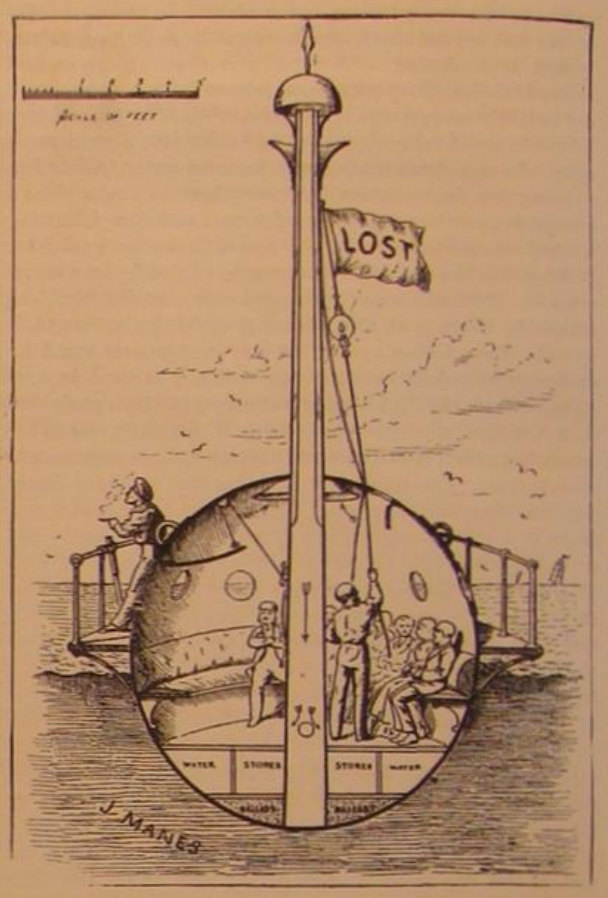
Take four or five parts by weight of dried and finely powdered brick earth, and one part of peroxide of manganese, and mix them with two parts of fine iron filings, which must be free from rust, one half part common salt, and one half part borax. Grind all fine together and mix intimately, then make into a stiff mass with water. The cement must be applied as soon as made: it is first gently warmed, and then exposed to a heat just short of whiteness. It is stated to be thus converted into a slag-like material which stands boiling water and all common heats. Another recipe is: Equal parts of finely sifted peroxide of manganese and finely triturated zinc, which are rubbed up to a thickish fluid with common water glass; this must be applied as soon as ready, and makes as hard a cement as the foregoing.—*Capital and Labor.*

Egyptian Petroleum.

It appears from the experiments of Dr. Weil that Egyptian petroleum has a specific gravity of 0·953. The Pennsylvanian and Canadian oils have a specific gravity from 0·790 to 0·830. The Egyptian variety gives a very fine lubricating oil, free of all tarry matter; but as an illuminating oil it is is inferior to American oils. It is better adapted, however, to serve as a fuel for steam generators, as it does not take fire until it attains a temperature of 135·6.

NOVEL LIFE BOAT.

We are indebted to the *Daily Graphic* for the accompanying cut of Mr. J. Manes' life boat, which seems to meet nearly every want of shipwrecked people. His boat consists of a hollow globe of metal, or wood, ballasted at the bottom, so that it will always right itself immediately on touching the water, and can never capsize even in the roughest sea. This boat has compartments for water, medical stores and provisions, bull's-eyes to let in light, a door for ingress and egress, a port-hole for hoisting signals to the mast, comfortable seats all round the inside for the passengers, and a double hollow mast for supplying fresh air, and for carrying off that which has become vitiated. On the outside of the globe boat runs a gallery, for the use of sailors in rowing, hoisting sail, discharging rockets, or steering. Of course the cases would be very rare when rowing, sailing, or steering would be required, but in case of need all three could be easily managed. A glance at the illustration will show how completely the passengers would be protected from rain and wind, and consequently, to a great extent, from cold; this is a very important point in Mr. Manes' design, as we all know that very many persons, not merely women and children, but often hardy men, only escape drowning to perish from exposure to the weather. Mr. Manes suggests that a propeller might be attached to the boat to be worked by a crank turned by the passengers on the inside. It is calculated that a boat, such as is represented in our engraving, twelve feet in diameter, would carry about fifty passengers. This boat can be carried on deck or hung over the stern on davits, in either of which positions it may be used as a cabin during the voyage.



A Vessel's Broken Shaft.

I have been down into the hold of the City of Berlin to examine the broken shaft. It is about seventy-five feet long, nineteen inches in diameter, and made of malleable iron. It broke near the middle in a diagonal split, when it was revolving fifty-eight turns a minute, and the force at the time the fracture occurred not only broke the shaft, but the journals by which the sections are attached by twelve rivets, each as thick as your arm, which were all broken short off. When I read of a steamer that has broken her shaft in the newspapers I have not paid much attention to it, but I shall hereafter.

The accident occurred under circumstances that no human foresight could prevent. It seems that the shaft in the center, where it refused to anneal, had a cavity about the size of your hand, and it was in this spot that the fracture occurred where no examination externally could detect it. This enormous shaft, after it was broken, kept whirling round, knocking to pieces such things as it hit, and had it not been for one of the engineers, who rushed into the engine room and shut off the steam, many lives would have been lost. The man has been rewarded by a handsome subscription among the passengers.—*Letter in Boston Advertiser.*

Two French astronomers, M. Andre and M. Angot, will visit California next year to observe the transit of Mercury, which occurs on May 6.

No less than five new varieties of sponges were discovered by Dr. Meyer, at the Philippine Islands and New Guinea, during his recent travels in the Eastern Archipelago.

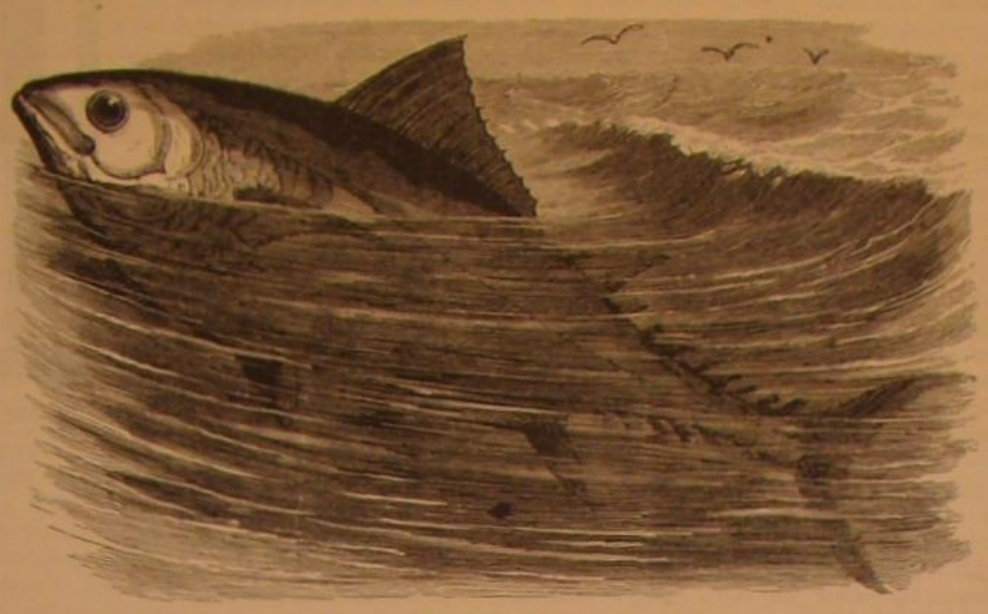
THE TUNNY.

On the shores of the Mediterranean Sea the tunny is found in great abundance, and forms one of the chief sources of wealth of the sea-side population. The flesh is highly esteemed and eaten both fresh and salted. It is extensively used in the Italian countries. It is pickled in various ways, boiled down in soups, and made into pies, which are thought to be very excellent, and possess the valuable property of remaining good for nearly two months. The different parts of the fish are called by appropriate names, and are said to resemble beef, veal, and pork.

The shape of the tunny is not unlike the mackerel, but is larger, rounder, and has a shorter snout. It belongs to the same family as the mackerel. The general average length is about four feet, but sometimes it attains a length of ten or twelve feet. One was recently caught in a mackerel net off Martha's Vineyard, and exhibited by Eugene Blackford, at Fulton market, New York city, that weighed over 700 lbs., and was fourteen feet and ten inches in length. De Kay, in his work, says that Dr. Storer mentions one that was taken near Cape Ann that weighed about 1,000 lbs. These are the largest fish caught in this country, of which we have any information.

The food of the tunny consists principally of smaller fish, although the cuttle fish forms some part of its diet. The color of the upper part of its body is very dark blue, the abdomen is white decorated with spots of a silvery luster. The sides of the head are white.

In May and June the tunnies move in vast shoals along the shores of the Mediterranean, seeking for suitable places to deposit their spawn. They are seen by sentinels, who are on the watch, and nets are prepared for their capture. These nets are of two kinds, one a common seine and the other called a "madrague," the principle of which is very much like that of the "corral," by which wild elephants are captured in India. The outer portions of the madrague intercept the fish, and on their endeavoring to retreat are forced to enter one of many chambers. They are thus driven from one chamber to another until they are forced into the last and smallest, which is significantly called the chamber of death. This chamber is furnished with a floor of net, to which are attached a series of ropes, so that by hauling on the ropes the floor is drawn up and the fish brought to the surface. They struggle fiercely for liberty, but are speedily stunned by blows from long poles, and lifted into boats.



THE TUNNY.

THE LANTERN FLY.

The curious species of firefly known as the *Fulgora Lanternaria*, or Lantern Fly, is represented in the annexed engraving. It is a large and handsome insect, with wings varied with black and yellow. The snout is long, straight, and curved upward, and the light is said to emanate from its extremity as from a lantern. It flies high and hovers about the summits of trees. Another species, the *F. candelaria*, of China, is of a greenish color varied with orange and black, with a long snout curved upward.

The causes which produce the light in the glow-worm and similar insects have been the subject of much discussion among naturalists. The most recent writers, however, agree that the luminous tissue is made up of fat globules, permeated by numerous tracheæ conveying air, with no traces of nerves or blood vessels. It does not appear satisfactorily determined whether there may not be in this tissue phosphorized fats which give forth light on contact with oxygen, hydrogen or nitrogen. The intermittence of the light is believed to depend upon the movements of respiration, and to be entirely dependent of those of the circulation. It is said that there is no heat accompanying the light, though it be a true combustion and a combination of carbon with oxygen; this may be owing to the rudeness or imperfection of our instruments, or to the slowness or peculiarity of the combustion.



THE LANTERN FLY.

Violet Ink for Rubber Stamps.

A VIOLET ink for rubber stamps is made by mixing and dissolving aniline violet 2 to 4 drachms, alcohol 15 ounces, glycerin 15 ounces. The solution is poured on the cushion and rubbed in with a brush.

An Ingenious Clock.

The firm of Messrs. Sloane & Co. have in operation a clock which, in addition to being a remarkable instrument, has an electrical attachment which renders it for the purpose it is used, that of rating chronometers, as near perfection as can be. It is not expected that the clock itself can ever come into general use, in view of the fact that it costs about $1,000, but a description of it is not on that account less interesting. It is called an astronomical clock, with mercurial compensating pendulum. Every time the pendulum vibrates, its lower point, made of platinum, passes through an insulated bulb of mercury, which alternately breaks and connects the circuit of a battery with a little sounder that taps the seconds. To this sounder is attached a little ratchet wheel with ten ratchets, and at each tap of the sounder the wheel moves one ratchet. At the tenth ratchet a platinum arm goes into a drop of mercury, making a circuit with another sounder, thus giving every tenth second a tap which, being louder than the other, is easily distinguishable. The ten-second sounder is the invention of Mr. Sloane and Commodore Dimpfel, and is now being introduced into the Naval Observatory. It enables the operator at the first rating to rate the chronometer to half a second, and at succeeding ratings to reduce the computation of the error to an infinite fraction, and by it the operator can rate chronometers almost as fast as they are put before him. The convenience lies in the fact that every tenth second being distinguishable by sound, the clock need not be watched.—*Baltimore American.*

To preserve gum solutions, a few drops of oil of cloves, alcohol, or acid will preserve a quart of the mucilage of gum arabic or gum tragacanth from turning sour. A small quantity of dissolved alum will preserve flour paste.

Military Telegraph Lines Across the Continent.

During the last two years the signal service branch of the government, under the direction of General Myer, has performed considerable work in the extension of military telegraph lines. The United States now runs and operates thirteen hundred miles of wire in Texas, and about fourteen hundred miles in Arizona and New Mexico. Recently, near Santa Fé, New Mexico, the New Mexico and Arizona systems were connected, so there is now a continuous Southern line across the continent. At Santa Fé the Western Union lines running from Denver, Colorado, into New Mexico, connect with the government wires, although the latter operate the line from Santa Fé, New Mexico, to Puebla, Colorado. It is now in contemplation to connect the Texas and New Mexico divisions by building down the Rio Grande from Mesilla, New Mexico, and El Paso to Fort Stockton, Texas, a distance of two hundred and fifty miles. The government wires in Texas connect with the Western Union line from New Orleans and Galveston. The appropriation of $50,000 for building and repairing in New Mexico and Arizona is almost exhausted, but the actual work accomplished has exceeded the Congressional estimates as to the number of miles that could be built with the sum appropriated.

Lieutenant Reade, under General Myer's direction, has built four hundred miles and rebuilt six hundred miles. The rebuilding consists in putting in new poles to take the place of inferior material, which was hastily put in some years ago. An ingenious method of utilizing the scrubby mesquit wood, in connection with soft and perishable timber like cottonwood and poplar, has been devised. The last-named woods will decay below the surface of the ground in two years' time, but when exposed to the dry atmosphere they will last a great many years. The mesquit is almost impenetrable, but its gnarled, misshapen, and dwarfed nature renders it unfit for use as a pole. In order to utilize both, the mesquit is put into the ground as a stump, and the poplar fastened to it by means of wire clasps and iron spikes.

The military telegraph line is not equal to the Western Union line in point of durability. The wire, however, is of the best class, and the general electrical apparatus is good, but the poles are lighter and shorter. As it was necessary to haul the timber for wire supports over the desert in wagons, the economy of transportation had to be studied, and the material of the country utilized. There is a rumor that the Western Union will purchase from the government the military line from San Diego to Yuma.—*San Francisco Bulletin.*

Red Mountain Iron Ore.

A letter from Birmingham, Ala., to the Louisville *Courier-Journal* says: The Red Mountain range is a solid mass of iron ore of fine quality. At one place the bank has been opened, and thousands of tons were piled up waiting to be transformed into useful articles. A company has been formed in Birmingham, and will shortly erect a furnace and rolling mill and utilize a portion of this deposit. I say a portion, for in the county in which Birmingham is situated I am told that there are twenty-five miles of the Red Mountain range which are nearly all solid ore. In this section of the State the deposits of coal and iron ore are immense enough to supply the world for ages. The question was, could the coal be used to manufacture the iron? Making iron with charcoal was too costly a process. The Eureka Company, composed mainly of Louisville and Cincinnati capitalists, undertook to solve the problem, and established a furnace at Oxmoor, and did solve it in a most satisfactory manner. The coal makes the finest sort of coke.

ON the outlet of Sterling Lakes, in the southwestern part of Orange Co., N. Y., is still in operation the iron works founded by Lord Sterling 25 years before the revolution. The first anchors ever made in America, it is believed, were forged by these ancient works in 1752. The great chain, which was stretched across the Hudson River to obstruct the passage of the British fleet, was made at Sterling Works in 1777. The chain weighed 186 tons, and was six weeks in making. It was transported in links to West Point in carts drawn by oxen. Each link weighed 150 lbs.

AN ARTIFICIAL FLOWER THAT BLOOMS.

French artificial flowers are now made so closely to resemble genuine blossoms that it is difficult, save by a close inspection, to detect the imitation. In order to render the counterfeit still more complete, the present inventor has devised a flower which can be worn either as a bud or blossom, and can be folded or expanded as desired, so that it mimics the natural blooming of cut flowers.

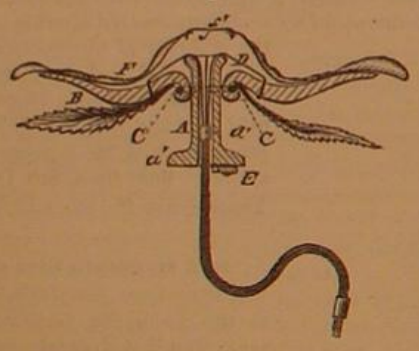
Fig. 1.



A is a small tube, Figs. 1 and 2, of such a size that it may be readily passed through and worn in a buttonhole, and which has a flange, a', formed around its end. The other end of the tube is flared a little, and around it are placed the inner ends of four leaf-shaped arms, B. The inner ends of the arms, B, have circular hooks formed upon them to receive the rubber ring spring, C. To the arms, B, a little above their hooks, are attached the ends of threads, D, which are passed through the tube, A, and have a bead, d', attached to them in such a position that it may be within the tube, A, when the arms, B, are expanded, and when the arms, B, are drawn together, by pulling upon the threads, D, it may be at the rear end of the tube, A, so that it may be caught upon the said end, as shown in Fig. 1, to hold the arms, B, closed. By this construction, by disengaging the bead, d', from the end of the tube, A, the rubber spring, C, by drawing upon the hooks of the arms, B, will expand the said arms. If additional security is required for holding the arms, B, closed, a button, E, may be pivoted to the end of the tube, A, having a notch formed in its edge to receive the threads, D, so that by passing the button, E, between the end of the tube, A, and the bead, d', the arms, B, may be held securely in place when closed.

F, Fig. 2, are the petals, the outer parts of which are attached to the outer parts of the arms, B, which represent sepals. The inner ends of the petals, F, are connected across the end of the tube, A, by threads, f', to keep them in proper

Fig. 2.



position. When the flower is closed the petals, F, fold at a little distance from their inner ends.

Patented through the Scientific American Patent Agency May 1, 1877, by Mr. Stacy Potts, of Philadelphia, Pa.

A New Invention in Telephones.

Mr. T. A. Edison has invented a new telephone, which is thus described:

The transmitting apparatus consists simply of a long tube about two inches in diameter, having one end covered with a thin sheet brass diaphragm which is kept tight by a stretching ring. In the center of the brass diaphragm is riveted a thin disk of platina, and immediately in front of this disk is an adjustable platina-pointed screw secured to a rigid pillar.

To transmit the music it is only necessary to sing or play into the open end of this tube. This causes the diaphragm to vibrate, and the platina points, meeting, make the circuit, and the electric current transmits every vibration over the wire to the receiving end.

The receiving apparatus employed by Mr. Edison for reproducing the tones is based upon an original discovery made by him some five years ago. This discovery was that when a piece of paper moistened with certain chemical solutions is laid upon a metallic plate connected to the positive pole of a battery, and a platina-faced wire connected to the negative pole of the battery is drawn over the paper, the passage of the current through it causes all friction to disappear, and the platina-faced wire slides over the paper as iron upon ice; but if the current be interrupted, this effect instantly disappears, and the normal friction of the paper causes the wires to be drawn over it with difficulty. This principle is applied to the receiver—a resonant box, a drum or wheel having flanges on both sides. This wheel is secured to a shaft rotated by a handle. A continuous strip of paper from the reel passes over the drum, the surface of which is roughened. Resting upon the drum is a smooth platina point upon the spring, which is secured to the center of the resonant box, and presses the platina point with considerable force upon the chemically prepared paper. The current from the battery passes to the spring, to the platina point, thence through the moist paper—which in this state is a conductor—thence to the drum, and back to the battery.

The operation is as follows: When the handle is turned the paper passes forward, and the normal friction between the paper passes forward, and the normal friction between the point and the paper serves to give a forward motion to the spring; hence one side of the resonant box is drawn out. If now a wave of current passes through the paper, all friction ceases, and the spring not being pulled, the side of the resonator regains its normal position; and this takes place at each vibration. By means of this friction the most feeble currents, which would not produce the slightest effect upon an electro-magnet, thus exert extraordinary strength. This apparatus will respond and reproduce with great power the highest notes of the human voice, which are nearly inaudible when magnets are employed, the slowness of their operation being due to the time required for the magnetization and demagnetization of currents, which delay the action and mutilate the signals.

This description refers more especially to the apparatus for the transmitting of the human voice in tones or singing. The only difference between this and the speaking telegraph proper, however, is in the substitution of a plumbago point for the platina point in the adjustable screw of the transmitter. This again is another original discovery of Mr. Edison's, viz., that plumbago changes its electrical resistance with enormous rapidity under pressure, the effect in this application being that when the diaphragm is vibrated weakly contact is made with the plumbago point very lightly; and the resistance of the plumbago being but slightly reduced, a weak current is sent out from the battery, and a weak effect produced at the receiving station. When, however, a strong pressure of the diaphraghm is effected, by reason of the exercise of a more powerful vibration of the voice, the resistance is very greatly reduced, and a strong current passes to the line and a strong or loud effect is produced at the receiving station. Hence the amount of power, with all its fine gradations generated by the voice at the transmitting station, is transmitted in its proportions to the receiving instrument, and thus the fine articulation of the voice is obtained. This of itself is a wonderful invention, and will be of great value to electricians in other fields. The ability to send from a battery currents of different strength automatically is a new and valuable invention in electricity.—*Philadelphia Press.*

Balloons in War.

M. Menier, an inventor of a military hot air balloon, recently delivered in London a lecture on war time aeronautics. In conducting experiments at Woolwich, his aim has been to find a balloon which could ascend and descend rapidly for a prolonged period, could be steered, and could proceed against the wind. Rejecting hydrogen gas as an inflating medium, because it could not be generated in the air, and escaped very freely, compressed air for the same reason, and mechanical force as cumbrous and unworkable, he chose hot air, because, although it requires greater cubical capacity, the material employed for the balloon need not be specially prepared, and is therefore lighter and less liable to spontaneous combustion. By employing a special kind of fuel, the balloon can be kept up in the air for twenty or twenty-five hours, while considerable changes in the density of the air, and consequent rapid ascents and descents, are rendered easy. To his balloon, which is spherical in shape, M. Menier affixes wings all round, except in front, and a tail behind, managed by the aeronaut, acts as a rudder.—*Philadelphia Ledger.*

A New Steam Street Car.

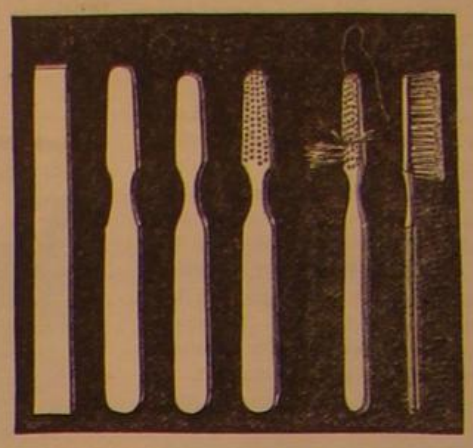
General John D. Imboden has invented a system of steam for street cars that promises to influence in a large degree the railway companies and the public in their decision as to whether steam or horse power shall be generally used for the locomotion of these conveyances. The engine is an independent sub-motor—a complete machine of itself, and can be attached to any of the present horse cars. It is simple, easily handled, cheap, and, better than all, causes no discomfort to passengers, it being out of their sight, smell, and hearing. It has its own framework, wheels, and springs, carries its coal, water, and engineer, and sustains half the weight of the car and passengers, the other half being carried by a single pair of car wheels, just in front of the rear platform. The car body is pivoted at its front end, on the engine, resting on a bed plate and springs over the boiler. The engine has four driving wheels, with a wheel base of only four feet, and, owing to the simple, pivoted connection with the car body, it is capable of curving freely. The boiler is horizontal, with simply a vertical furnace and steam dome under the driver's seat, which is outside the front of the car.

This test car has been made of the same size as that of an ordinary horse car, so as to demonstrate thoroughly that in order to convert the latter into a locomotive nothing is necessary but to take off its front wheels, put this handy little engine in their place, and nail up the front door. The interior and the rest of the car can be left intact. The new car occupies four feet less street space than one of the dummies now in use on Market street, and ten feet less than a horse car, the horses being dispensed with.—*Philadelphia Times.*

THE peculiar odor of Roquefort cheese has been found by Mr. Mencki to be due to a volatile oil of a yellow color, neutral reaction, and sharp burning taste. He separated the oil by distilling a portion of the cheese with sulphuric acid.

BRUSHES.

In making brushes by hand two different methods are pursued for inserting the bristles into the holes made for their reception in the pieces forming the backs. The workman following the first method gathers the bristles into little bunches, winds thread around their lower ends, dips these into molten pitch, and insert them into the holes with a slight rotary motion. In the second mode of procedure a loose bundle of bristles is laid with its center exactly over one of the holes, a strong cord or thin brass wire is made to enter the hole from the back, encircle the bunch, and pass



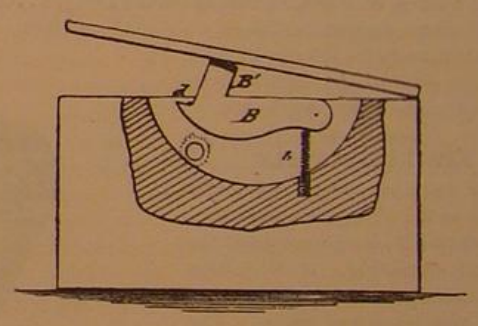
MODE OF FASTENING BRISTLES IN TOOTH BRUSHES.

out again, when on drawing it taut the bundle of bristles is broken in the middle and made to stand erect. The surface of the brush is afterwards leveled by means of a knife or other sharp cutting instrument.

Some small brushes will occasionally be met with, the backs of which, though forming but one piece, do not, however, exhibit any traces of holes or wire. These peculiar brushes are made by first drilling a series of longitudinal canals into the further end of the back, with which canals the bristle holes communicate. The wire or thread is passed through these canals, drawn out at each hole, twisted into a loop in which the bristles are laid, and finally drawn taut again. These openings in the end are afterwards filled up, previous to polishing.

A CIGAR-CUTTING CIGAR BOX.

Our engraving represents one of those ingenious little ideas which almost always prove remunerative to their originator. Plenty of devices have been suggested for cutting off the ends of cigars: some have been placed in watch charms, others in ornamental cigar stands, but no one seems hitherto to have thought of placing the cutter in the cigar box itself, as is done in the present invention.



B is the cutting knife acted upon by a spiral spring and retained in its recess by a stop pin, *d*. The knife has a handle at B'. To cut off the cigar end it is necessary only to insert the extremity in the aperture made in the box, and press down the cover which acts on the knife.

This device was patented through the Scientific American Patent Agency May 22, 1877, by Mr. A. E. Ebert, of Knoxville, Tenn.

Theory of Luminous Flames.

Experiments on the above subject are given by K Heumann, in which he finds that carbonaceous matter will give luminous or non-luminous flames, according as the temperature of the flame is high or low; diluting the gaseous combustible with indifferent gases also requires a higher temperature to cause a separation of the carbon, and thus produce luminosity. Reduction of temperature in a flame prevents either partially or entirely the formation of carbon, consequently the author thinks that the deposition of carbon on cold surfaces in a flame is not the consequence of cooling, as a deposition may be formed on red hot surfaces, but burns away in contact with air. In burners of different materials, those of iron were found to prevent the luminosity of the lower part of the flame to a greater extent than those of steatite, also when the burner is heated, a greater amount of light is produced, the consumption of the combustible remaining the same. Herr Heumann thinks that by heating the burner the luminosity is increased, and extends to a greater extent over the lower part of the flame.—*Nature.*

A GOOD whitewash for walls is made by adding to fresh slacked lime and water, a solution of starch, a little salt, and a few drops of dissolved indigo or bluing.

The Melting Point.

The theory that iron in a cupola is melted all up through the stock is wrong, for every cupola has a certain point at which the iron is melted, and there is not a pound of iron melted in any cupola until it comes down to the melting point. The melting point in a cupola is generally from six to eighteen inches above the tuyeres, but it may be raised or lowered a little by increasing or diminishing the amount of fuel in the bed: but if we get the bed too high it throws the melting point too high, and the result will be slow melting. If we get the bed too low, it will allow the iron to get below the melting point, and the result will be dull iron; and in order to do good melting in any cupola, it is very essential that the melter should know the melting point of his particular cupola. The melting point of a cupola is the point at which the most intense heat is created by the action of the blast upon the fuel. This intense heat at the melting point will cut the lining more than at any other place in the cupola, and the lining will generally be found to be cut out more just above the tuyeres than at any other point, which indicates the melting point of the cupola. If tuyeres are put in so as to distribute the blast evenly through the stock, and the charges of iron and fuel are put in evenly, and every charge leveled up properly, the heat will be even all through the cupola, and the lining will be cut out in a regular belt at the melting point all around the cupola. On the other hand, if the tuyeres are not put in so as to distribute the blast evenly through the stock, or the charges of iron and fuel are not put in even and level, or if the fire is all on one side of the cupola, the heat will not be even through the cupola, and the lining will not be cut out in a regular belt at the melting point, but will be cut full of holes, which shows that the cupola is not melting all around, but is only melting in spots. By this irregular charging and melting in spots, the cupola may be reduced to half its melting capacity, which accounts for a cupola melting fast on one day and slow on another day. As before intimated, the melting point in a cupola is the point at which most intense heat is created by the action of the blast upon the fuel. When the blast enters the cupola it is cold, and as it passes through the heated fuel it becomes hot, and as it becomes hot it creates heat by combination with the fuel, and makes an intense heat. If we have a very strong blast it will travel fast and will pass through the fuel rapidly, and it will have to pass through more fuel before it becomes heated sufficiently to make an intense heat by combination with the fuel. On the other hand, if we have a mild blast, the blast will pass through the heated fuel slowly, and is more heated, so that it does not have to pass through so much fuel before it becomes sufficiently heated to make an intense heat by combination with the fuel; so that when we have a strong blast the melting point of a cupola is higher than when we have a mild or weak blast; and the bed has to be put in higher in a cupola with a high melting point than in a cupola with a low melting point, which accounts for one cupola requiring more fuel in the bed than another cupola does. When the cupola is in blast, the bed or fuel in the bottom of the cupola is constantly burning up, and the unmelted iron will get down below the melting point. To prevent this, the melter has recourse to charges of fuel between the charges of iron, and as the charges of iron are melted and drawn out at the tap hole, the charges of fuel come down and replenish the bed and again raise the melting point; the next charge of iron comes down and is melted and drawn out; the bed is reduced and is again replenished by the next charge of fuel, and so on through the whole heat. If we supply too much or too little fuel between the charges of iron, the melting point will be raised too high or reduced too low, or in other words, if we have a melting point of ten or twelve inches in height in our cupola, and we supply twenty or twenty-five inches of fuel, this extra fuel must all be burnt up before the iron can come down to the melting point; and we will not have a continuous melting, but will have a delay between each charge of iron. If, on the other hand, we have only five or six inches of fuel between the charges of iron, when we should have ten or twelve inches, this small amount will not more than half replenish the bed, and the unmelted iron will get down too low and will not make hot iron, and the iron may not be melted at all; and in order to do either fast or economical melting, we must not use either too much or too little fuel, and we must have the fuel distributed so as to suit the particular cupola in which it is used; for, as before explained, there are scarcely two cupolas that will melt exactly alike on account of the melting point being higher or lower, which is caused by a stronger or weaker blast, or by more or less draught; and in order to do good melting, the melter should not charge his cupola just the same as some other cupola of the same size is charged because that cupola does good melting charged in that way; but he should vary the height of the bed and the amount of fuel between the charges of iron, and the amount of iron on the bed and on each charge of fuel, until he finds the exact proportions that will do the best melting in that particular cupola.

Melters, in changing from one cupola to another, will generally have trouble in making hot iron, and they will often make a complete failure of melting in a strange cupola. This is simply because they undertake to charge that cupola the same as some other cupola that they have been melting in, and they never pay any attention to the draught, blast, or the melting point of the cupola, which is the cause of their failure in melting in a strange cupola. When a melter takes charge of a strange cupola, his first object should be to study the draught of the cupola, the nature of the blast, and to ascertain the melting point of the cupola. He can generally tell where the melting point is by noticing where the lining is cut out the most, and he can tell whether the cupola is melting evenly, or is only melting in spots, by noticing whether the lining is cut out in a regular belt all around the cupola, or is only cut out in holes, as before explained. He can tell whether the bed is too high or too low by noticing how the cupola melts. He can tell whether he is using too much fuel between the charges of iron, or if he is putting in the charges of iron too heavy, by noticing whether the cupola melts regularly or not, and by noticing if it makes regular iron; for if the iron is very hot in one part of the heat and dull in another part, it is a sure indication that the fuel is not properly distributed through the iron, and it should be remedied by increasing or diminishing the weight of the charges of fuel or iron.

In melting with coke, the melter cannot put in his iron in as large charges as he can with coal, because the coke is more bulky than coal, and he has more bulk in the same weight, and if he puts the same weight of coke between the charges of iron as he does of coal, the bulk of the coke will raise the iron above the melting point, and the iron cannot be melted until part of the coke is burnt up so as to allow the iron to come down to the melting point, and the result is that he does not have continuous melting, but he has a delay between each charge of iron, and the iron will probably be dull in the latter part of each charge; but the melter can do equally as regular melting, and can do faster melting with coke than he can with coal, by putting in the coke and iron in smaller charges, and more of them, which proves conclusively that good melting can be done with almost any fuel and in any cupola, if the melter understands his business; but he may not be able to do as economical melting in a poor cupola as he can in a good one.—*From "Founding of Iron," by Edward Kirk.*

Iron-Steel.

MM. Asbeck, Osthaus, and Eicken, of Hagen, Westphalia, says the *Revue Industrielle*, have recently manufactured a metal composed partially of steel and partly of iron to which they give the name of iron-steel. The novelty of the combination consists in the introduction of a thin sheet of iron between the surfaces to be welded. A cast iron mold is divided into two compartments by means of a transverse plate or of a tube placed in the interior and the two metals are poured into the respective compartments. Before fusion both metals are submitted to complete refining which removes all matters which hinder welding. They are then turned into the mold, the sheet iron partition in which serves to prevent their mingling and to facilitate welding by being itself brought into a state of fusion. The success of the operation depends considerably on the preparation of the metals, on their readiness to weld, and on the thickness of the partition. The last is determined experimentally and the dimensions differ according to those of the ingots to be produced. The metal thus prepared is said to be adapted for the fabrication of rails, anchors, and armor plates, etc., where the hardness of the steel diminishes the wear and increases the resistance of the masses. In the construction of safes, plates of this combination are said to be proof against attempts to break or drill through them. In all portions of machines or for tools which support or transmit heavy pressure or undergo instantaneous and powerful stress, as in rolls or axles the metal is claimed to possess very superior advantages.

Gas Main Leakage.

There appears to be a good opportunity for some one to invent a cheap method of rendering the pipes and mains which conduct illuminating gas under city streets thoroughly tight. At the present time there is always leakage, and when the earth is broken to reach water pipes, etc., in our thoroughfares, the overpowering stench shows the ground air to be thoroughly permeated with gas. Even if this, as Dr. Chandler says, is not directly detrimental to health is at least exceedingly disagreeable, and without doubt it exhales from the ground in sufficient amounts to add its quota to the combined odors of garbage and refuse which pervade the densely populated districts of the city. The principal parties affected by leaky gas mains are the gas companies, and we are informed that the yearly loss from this cause reaches considerable figures. Gas pipes are tested by closing the ends, plunging them in water and pumping in air, the escape of which indicates the existence of flaws. If these are large the pipe is rejected, if small they are closed by hammering; but that this system does not entirely guard against leakage, is, as already stated, evident. Coal tar has been used as a varnish for outsides of pipes with fair results; but cannot the metal of the pipe itself be so mechanically treated, by compression or rolling either outside or inside, that it shall be wholly impervious to gas?

Self-Vivisection.

It is not often that an inventor has such an implicit faith in his invention, or the nerve to demonstrate the fact as Dr. Waters, of Salem, recently showed before the Massachusetts Dental Society. He stated that bicarbonate of soda, such as used for cooking purposes, or any other alkali in neutral form, would afford instantaneous cessation of pain from the severest burns and scalds, and would cure such injuries in a few hours. Deliberately dipping a sponge into boiling water, the Doctor squeezed it over his right wrist, producing a severe scald around his arm and some two inches in width. Then, despite the suffering occasioned, he applied the scalding water to his wrist for half a minute. Bicarbonate of soda was at once dusted over the surface, a wet cloth applied, and the pain, the experimenter stated, was almost instantly deadened. Although the flesh on the wrist was literally cooked down to the sweatglands, and the wound was of a nature to be open and painful for a considerable time, on the day following the single application of the soda, the less injured portion was practically healed, only a slight discoloration of the flesh being perceptible. The severer wound in a few days, with no other treatment than a wet cloth kept over it, showed every sign of rapid healing.

Purification of Bismuth.

Bismuth has been purified by Mr. E. Smith in this way: To every sixteen parts of bismuth, kept in a fluid state, at the lowest point of its fusing temperature, he added one part of a mixture composed of three parts of flowers of sulphur and eight parts of cyanide of potassium. The bismuth was kept melted for fifteen minutes after the mixture was introduced, and then allowed to cool.

NEW BOOKS AND PUBLICATIONS.

STRENGTH AND DETERMINATION OF THE DIMENSIONS OF STRUCTURES OF IRON AND STEEL. By Dr. J. J. Weyrauch. Translated by A. Jay DuBois, Ph.D. New York: John Wiley & Sons, 15 Astor Place.

Dr. Dubois' translation of Dr. Weyrauchs' work will especially commend itself to engineers as being prepared at the especial request of the author, and as it consequently is the only one vouched for by Dr. Weyrauch, its accuracy and authenticity need no better recommendation. As to the value of the book, it will be sufficient to say that its object is to substitute the legitimate deductions of varied and careful experiment for abstract and purely theoretical assumption; to furnish in lieu of arbitrary rules accurate and reliable formulæ involving all the necessary data for a simple and rational method of dimensioning in a systematic manner covering all cases. "What has for the last hundred years justified the assumption that a piece which has once successfully resisted a certain stress, must necessarily resist equally well an independent number of repetitions of that stress? How can it be held that it is a matter of indifference whether a piece is subjected always to the same constant load, or is alternately loaded and then unloaded, or is even subjected to alternate strains of tension and compression. * * * By assuming the strength which is not constant, as nevertheless constant for every member of a construction, the degree of safety of the different members varies. The least safety of any place in the structure is however the measure of the security of the whole. If one member gives way, it is a matter of little moment whether in falling, the other members hang together or not." This extract from the translator's preface will give the key to the tendency of the work. In order to determine the required area of cross section of a part to safely resist a given stress the practice has been to divide the greatest stress by the assumed allowable stress per unit of area and the resulting general value is taken as invariable no matter whether the stress be occasioned by dead load or whether it undergoes sudden changes. After a long series of experiments Wohler reached the conclusion that "rupture may be caused not only by a steady load which exceeds the carrying strength, but also by the repeated application of stresses none of which are equal to this carrying strength. The differences of these stresses are measures of the disturbance of the continuity, in so far as by their increase the minimum stress which is still necessary for rupture diminishes." Starting from Wohler's law which does not cover all cases, Dr. Weyrauch reviews and adopts Launhardt's formula which he shows to be applicable when a piece is always extended or always compressed or generally submitted to stress of a single kind. In the succeeding chapter (chap. IV) the author himself deduces a formula, instances of pieces subjected to alternate tension and compression. The subject matter of the remainder of the volume is of a directly practical nature. Chapter V deals with carrying strength for compression and tension, and embodies the results of a host of valuable experiments. Then follow sections on transgression of elastic limit, annealing, tempering, influence of form, constituents of steel and iron, influence of temperature, estimation of material, allowable stress per square centimeter, method of determining dimensions, shearing strength and rivetting, the last very fully discussed. The book ends with an appendix in which other methods are considered, and Professor Thurston adds his excellent papers on strain diagrams with which our readers are already in some measure familiar. There are several good illustrative plates, some valuable reduction tables, and in general as the translator claims the subject is capitally set forth "in a shape to meet the daily wants of the practising engineer and constructor."

A PRACTICAL TREATISE ON LIGHTNING PROTECTION. By Henry W. Spang. With Illustrations. Philadelphia: Claxton, Remsen, & Haffelfinger, 1877.

This little treatise contains quite an amount of interesting practical information on the subject of lightning and the means to be employed for securing immmunity against its effects. Its main object seems to be however to introduce to public notice a new mode of obtaining a proper ground connection, which if capable of performing all that it is claimed for it can hardly fail to meet with extended favor. It strongly recommends the old but excellent idea of making all large masses of metal about a building, such as metallic roofs, rain and gas pipes, etc., serve as lightning conductors, and shows that they will afford absolute protection if connected properly with the earth. Explicit directions are given for ensuring the safety of structures of all kinds, also of ships, oil tanks, telegraph poles, wooden bridges, steam boilers, etc. The work will be found useful in many respects and will no doubt be fully appreciated by all who may have occasion to consult it.

THE FOUNDING OF METALS. A Practical Treatise on the on the Melting of Iron. By Edward Kirk. Price $2. Published by the Author, Albany, N. Y.

A capital little work written by one, who as every page indicates, is practically familiar with the subjects treated. The volume contains numberless suggestions of a type not found in ordinary treatises on metallurgy, and in brief it belongs to that class of books which intelligent workmen might often prepare regarding their trades, and of which there can never be a superabundance. The work is comprised under the three general heads; iron, founding of alloys and minerals, and gases, and each topic is fully discussed in a series of short pointed chapters. The author writes in a pleasantly readable way, altogether different from the style of the ordinary technical treatise. We can commend the book, as well worth careful perusal by both employers and workmen in the metal industries.

NARRATIVE OF THE POLARIS EXPEDITION. Edited by Rear Admiral C. H., Davis, U. S. N. Washington, Government Printing Office.

As its title indicates this large and finely illustrated volume gives a complete history of the North Polar Expedition which set out in 1871 in the steamer Polaris under command of Captain Charles F. Hall, and which virtually terminated or rather failed with the death of that brave explorer. The voyage of a portion of the survivors of the crew, detached from their vessel and afloat on an ice floe has already passed into history as one of the most wonderful of escapes from apparently certain destruction. The late Admiral Davis entered enthusiastically into the labor of condensing all the journals, reports and narratives of the officers and crew of the Polaris into one connected recital of events. This has been produced in a manner which merits the highest praise. Admirably and graphically written, lavishly embellished with illustrations from photographs, the volume is one which, unlike most emanations of the Government press may be read with profit and interest from beginning to end.

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 BARBED FENCE.

Lyman P. Judson, East New Market, Md.—In this invention a strip of any suitable metal has perforations made at such intervals as may be desirable. In these perforations wire barbs are placed, and, by means of suitable tools, are bent down parallel to the sides of the strip for a small portion of their length, and then are bent outward at right angles to the strip. The wire barb is clasped upon the sides of the strip loosely, so that it will yield sufficiently to not tear the flesh of an animal, or draw wool from sheep.

IMPROVED ANIMAL TRAP.

Edgar B. Beach, West Meriden, Conn.—This invention is an effective trap for catching animals by killing the same at the moment when they try to take the bait; and it consists of a piston at the end of a pivot arm propelled in a circle by the discharge of a gun barrel, as soon as the spring-acted hammer of the same is released by nibbling at the bait.

IMPROVED FRUIT DRYER.

William M. Eddelman, Wahoo, Neb.—This invention is an improved fruit dryer of simple and cheap construction, that may be used on any stove or furnace without danger of smoking, burning, or charring the fruit. It consists of a double pan having a bottom receptacle filled with water by a funnel-shaped spout, that is surrounded by a dishing plate to catch any water forced out by the steam. The pan is of flat shape, and has a double bottom that forms a receptacle for water and steam below the bottom of the drying pan. The water is filled into the receptacle by a funnel-shaped corner spout, with outward inclination, through which the steam formed in the receptacle may escape. The heat produced by the generation of steam in the receptacle is claimed to dry the fruit in a superior manner, without exposing the same in the least to the danger of being burned or charred, or of obtaining a smoky taste.

IMPROVED FEED RACK.

William H. Howard, Albany, Wis., assignor to himself, J. F. Tracy, and Jonathan H. Roberts, of same place.—This is an improvement in the class of devices for feeding stock in which the supply is regulated by sliding or swinging valves. It relates to the specific construction and arrangement of valves with reference to the hopper and feed trough proper. A hopper contains grain or other feed, in the bottom of which hopper holes are made through which grain may pass to the boxes that are placed below the hopper in the trough upon each side of a central partition. Slides or valves are placed in the bottom of the hopper and in them holes are made, which correspond with the holes in the bottom of the hopper. These slides are capable of being moved by levers, so as to open or close the holes in the bottom of the hopper. Crossbars extend across the hopper above the slides, and serve the double purpose of keeping the slides in their places and of stirring the grain when the slides are moved.

IMPROVED HOG CATCHER.

James H. Eames, Emerson, Iowa.—This is an improved device for catching hogs, sheep, calves, and other small animals, and poultry, which holds the animal securely. It consists in the combination of the pivoted curved jaws, provided with shanks of different lengths, the curved bar, provided with a socket to receive the handle, the jointed bar, the sliding cross or T head tripbar, the spring, and the cord or strap with each other. The jaws are curved inward or toward each other, and the ends of which overlap each other. The jaws cross and are pivoted to each other, and are widened at their point of crossing to give them a wide bearing, to keep them from turning or getting out of line with each other. The shanks of the jaws are made of different lengths, and to the longer shank and its jaw are attached the ends of a curved bar, to which is attached a socket to receive the handle. The handle, for ordinary purposes, should be about ten feet long.

IMPROVED BEEHIVE.

Charles J. Sperry and Lyman Chandler, New London, Minn.—The object of this invention is to improve the construction of the beehive for which letters patent No. 143,307 were granted to the same inventors September 30, 1873, so as to make it more convenient in use, enabling the bees to be more readily handled and controlled. The bottom of the hive, the lower side of the forward edge of which rests upon the table, is supported in an inclined position by legs attached to the back of the hive, to the lower edge of which the bottom is attached, and which is vertical, or nearly so. The front of the hive, the upper part of which inclines outward, is attached at the lower edge to the bottom, at a little distance from its edge. The projecting part of the bottom serves as a table for the bees to alight upon. In the middle part of the lower edge of the front is formed a long notch for the ingress and egress of the bees. The size of this passage is regulated by a slide placed in a groove in the lower edge of the front, and which is supported adjustably by two wedges placed beneath it at the ends of said notch. By this arrangement, by adjusting the wedges, the slide may be raised to permit workers and drones to pass in and out, or lowered to shut out the drones, while allowing the workers to pass in and out freely.

IMPROVED HAY DERRICK AND STACKER.

Richard N. B. Kirkham, Kansas, Ill.—This invention is an improved machine for elevating hay in stacking it in the field, which enables the hay to be raised upon the stack faster, and with less labor of man and horse, than is possible with the machines for this purpose now in use. It consists in the combination of the inclined circular track and its supporting framework, the circular plate and its pivoting shaft, the two parallel semicircular plates, and the two levers and their wheels with each other; and in the combination of the curved drawrod or sweep and its brace with the circular plate, and the two parallel semicircular plates, the two levers, and their wheels.

IMPROVED METALLIC FENCE CAP.

John D. W. Lauckhardt, Brooklyn, N. Y.—This improved fence cap serves the threefold purpose of a weather protector, an ornamental covering, and of a guard against the inroads of cats and boys; and it consists of a sheet or cast metal cap with tapering sides and spurred top.

IMPROVED IRON POST FOR WIRE FENCES.

John Plane, Belvidere, Ill.—The post is made of angle iron of any desired length and size, as circumstances may require. In one or both edges of the post are formed inclined notches to receive the wires. The wire is secured in the notches by buttons pivoted to the posts in such positions that they may be turned down upon said wire.

IMPROVED HAND SEED PLANTER.

Francis B. Preston, Fayette, Mo.—By suitable construction, as the slide is raised enough seed for a hill is taken from said hopper and dropped into the slot of the board, down which it passes and rests in the angle between plates. Whe the planter has been thrust into the soil the slide is pushed down, which forces one plate back and forms a space in the soil into which the seed drops. The seed is covered by the falling in of the soil as the planter is raised.

IMPROVED SLED BRAKE.

Ephraim M. Lawrence, Bryant's Pond, Me.—This is an improved brake for sleds, so constructed that the operation of holding back will apply the brake, and the operation of drawing will raise the said brake, and the device may be readily fastened to allow the sled to be backed without applying the brake.

IMPROVED FENCE.

James Garrett, Pembroke, N. Y.—This invention consists of two upright pieces, that are secured to a base block by a fastening wire passed around the block and attached by eyes to the upright. The latter carry the rails or intermediate blocks, and are rigidly secured to the ground by a lateral brace wire secured to and keyed by stakes into the ground.

IMPROVED GRAIN SCOURER.

James S. Hillyer, Rockford, Minn.—This grain scourer consists of an inclined revolving cylinder, the inner face of which is longitudinally corrugated and covered with a coating of emery.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED STONE DRILLING MACHINE.

Ferdinand Johnson, Toledo, O.—This is an improved drill for boring holes in rocks for blasting and other purposes. It consists of a connected cylinder and drill, that are lifted jointly by revolving cams, and rotated at the same time by suitable pawl and ratchet mechanism, operated by a pitman and pawl connection with a trap block, ratchet, and rack of a slotted sleeve, through which the cam shaft and lifting roller shaft pass. The drill shaft is vertically adjustable to any depth, and guided by rollers of the bed frame, the drill being readily moved from place to place by a truck under the bed frame.

IMPROVED GRINDSTONE SHARPENING ATTACHMENT.

Henry F. Bush and Martin L. Bush, Douglassville, Pa.—This invention is designed to provide for common grindstones an improved attachment by which the knives of moving machines may be sharpened in rapid and superior manner, two edges of adjoining knife sections being ground by one stone at one and the same time. It consists of a second grindstone of V diamond shape, that is hung in a suitable frame, centered to the shaft of the main grindstone, and revolved by belt and pulley connection with the same. The knife of the mowing machine is clamped on a base plate and reciprocated toward the oscillating grindstone by suitable mechanism.

IMPROVED FRUIT PARING, CORING, AND STONING MACHINE.

George Bergner, Washington, Mo.—This invention relates to such improvements on the apple parer, corer, and slicer for which letters patent were heretofore granted to the same inventor under date of January 9, 1872, and numbered 122,553, that the same may be used either for paring, slicing, and stoning or coring peaches or apples, or for the purpose of paring the fruit merely, as required. It consists of a recessed spring fork, that is revolved by a hand crank, in connection with a swinging and spring-acted paring knife, which is operated by a rack rod and gear, and automatically thrown in or out of motion by a worm thread of the fork rod, and a spring-acted rod holder. The fork rod holder is acted upon, respectively by a hook at the end of the sliding rack rod, or by a fixed lug of the revolving fork rod, and retained in or out of gear with the worm by suitable locking devices. A longitudinally sliding and sidewise swinging slicing knife is guided along the base frame and pushed forward for slicing and stoning the fruit. A swinging and spring-acted arm is attached to a short post of the rack rod, and engaged by a fixed lug or pin of the base frame of the apparatus, to throw the fruit off the fork when it is not desired to slice the same.

IMPROVED MACHINE FOR CUTTING SCREW THREADS.

Louis Bollmann, Vienna, Austria.—This invention relates to machinery for cutting screw threads. It may be applied for cutting regular or irregular forms, besides screw threads, the work receiving always a shape which is an exact counterpart of the acting surface of the cutter. Two or more screws of different pitch, besides any complicated form, can be cut at the same time. To give to the cutter the exact shape required an exact copy of the work is used, and by cutting into it, the teeth make a cutter out of it, which is then hardened. This cutter is then fastened to the lathe spindle in place of the work, while the unhardened cutter which is to be made is fastened on the cutter spindle. By bringing, now, both cutters in contact, the soft cutter will become an exact copy of the form required.

IMPROVED CAR COUPLING.

David R. Halter, Lee's Cross Roads, Pa.—This invention consists of a drawhead having hinged, spring-acted, and adjustable coupling link, in connection with a drawhead having a pivoted and weighted draw lever and a laterally sliding coupling and uncoupling pin.

IMPROVED ROLL FOR REDUCING TUBES.

William McKenzie, New York city.—The object is to reduce the size of tubing by drawing it between loose rollers while hot. The device consists in the arrangement of one or more pair of rollers in a hinged frame, which is capable of adjusting itself so that the distance between the rollers may be varied to accommodate pipes of different sizes.

IMPROVED ORE STAMP.

Thomas Schofield, Grass Valley, Cal.—This consists in the combination of a ring supported and guided by rollers, and carrying a number of cams, and a number of stamp rods having collars that are engaged by the cams as the ring revolves. The device is a portable and efficient quartz battery, which may be worked by horses or other animals, and by them be drawn from place to place.

IMPROVED CAR STARTER.

Andrew J. Curtis, Monroe, Me.—This is an improved device for attachment to street cars, so constructed as to enable the momentum of the car to be used for stopping it, and the same power to be applied for starting it. It is simple in construction and conveniently operated.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CARRIAGE BODY ADJUSTER.

Isaac Wilkins, Jr., Greenpoint, N. Y.—This invention relates to an improvement in carriage bodies whereby the door frame may be quickly and easily adjusted when the body sags so as to bind the door in the door frame.

IMPROVED DOOR BOLT.

Alpheus A. Dennett, New Britain, Conn.—This invention consists in the combination, with a sliding bolt, of a thumb piece having a crossbar, which, when the bolt is either retracted or projected, is capable of locking said bolt. To this end the crossbar of the thumb piece is turned at right angles to a slot of the guide casing of the bolt.

IMPROVED WAGON SEAT LOCK.

Charles E. Stone, Salisbury Mills, Mass.—The advantage claimed for this improvement is, that the seat may be readily moved from one position to another on the wagon body, and may be securely clamped. The device is a wagon seat lock provided with the beveled nib on the lower end of a swiveled plate, the same being arranged to enter a groove in the side board and catch under an iron strip.

IMPROVED LATHE FOR CUTTING SCREW TAPS.

George R. Stetson, New Bedford, Mass., assignor to himself and Morse Twist Drill Company, of same place.—This relates to improvements in machines for cutting taps or other forms, where a longitudinal slot or depression relieves the tool from work during a portion of the time of its revolution, so that when the cutting tool passes over the longitudinal slot or depression the motion of the blank being cut is more rapid than during the time the tool or cutter is at work.

IMPROVED ROOFING TILE.

Philip Pointon, Baltimore, Md.—The improvements embodied in this invention are designed principally to prevent the warping and twisting of the tile during the baking operation when arranged horizontally in vertical piles. The improvements consist in the peculiar formation of upper and lower lips on opposite faces and ends of the tile, which serve to couple the tile on the roof and yet permit them to be arranged parallel in the kiln. It also consists in extending the upper and lower lips past each so as to support the tile at the corners, and also in forming a raised ornamental figure in the center which supports the tile in the center during the operation of baking. A further improvement consists in forming the tile with a beveled face upon the lower side in order to strengthen the tile when laid upon the roof.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED HOOK FOR HARNESS.

Richard Lowell, Flushing, N. Y.—This is an improved water hook so constructed as to prevent the check from coming off the hook accidentally, and which will not prevent the check from being put on and taken off with facility. It consists in the combination of the U-shaped keeper with the neck formed upon the water hook at its bend. The body of the water hook, which may be of any of the ordinary shapes, is bolted to the saddletree in the usual way. Upon the forward part of the bend of the hook is formed a neck, around which the check passes. A U-shaped keeper, which is bent to correspond with the bend of the hook, has the arms which fit into recesses formed in the sides of the hook. The arms of the keeper are pivoted to the opposite sides of the hook at the lower part of its bend, so that it may be swung forward. In checking the horse, the keeper is swung forward, the loop of the check is put through it, and passed over the point of the hook, and the movement of the horse's head will draw it into place. In unchecking the horse, the loop of the check is drawn back and passed up over the point of the hook, and the movement of the horse's head will draw it out through the keeper.

IMPROVED MEDICINE CASE.

Jerome Millard, Pultneyville, N. Y.—This is a convenient and compact case for the use of physicians for carrying remedies. A box of suitable dimensions has a middle partition and covers at each side, that are hinged to the body of the box. The space on one side of the partition is divided longitudinally by a partition, and the space at one side of this partition is subdivided into smaller spaces for receiving bottles by the partitions, the space at the outer side being filled with small phials placed in removable pockets. A number of pockets are formed for receiving the phials, and a tray having pockets for receiving phials is fitted to the box above or outside of the pockets. The entire interior surface of the box and covers is covered with felt, velvet, or other soft or yielding material. The handle of the box consists of an oblong ring, which is pivoted in ears that are attached to the box by means of screws. The case is arranged to accommodate phials of different sizes, and is constructed so that every compartment may be readily opened. The whole forms a compact and convenient case for containing a number of remedies.

IMPROVED PULP ENGINE.

Edwin Sumner, Baldwinsville, Mass.—This improvement consists in arranging within the roll cover or hood of a paper pulp engine an inclined chute that receives the pulp thrown up by the roll, and carries it transversely toward the cutside of the curb, the object being to equalize the velocity of the circulation of the pulp in the curb, so that a homogeneous mass of paper pulp is produced.

IMPROVED PYROTECHNIC SIGNAL CARTRIDGE.

Jacob J. Detwiller, Jersey City, N. J.—This consists mainly in a cartridge having the usual percussion priming, and containing a propelling charge of gunpowder, a perforated wad, and a cylinder or ball of highly combustible composition, capable of giving out a red or white light when burned, and a closing wad, which completes the cartridge. It also consists in forming, on the percussion end of the cartridge, one or more projections, by which the color of the cartridge may be determined in the dark.

NEW HOUSEHOLD INVENTIONS.

IMPROVED CHAIR BRACE.

James W. Collins, Laramie City, Wyoming Territory.—This is a brace to be attached to an ordinary chair, to strengthen and stiffen it, and to draw its joints firmly together. It consists of a crosspiece attached to the under side of a chair bottom, and provided with sockets for receiving the upper ends of braces that incline downward and outward, and are attached to the legs of the chair near their lower extremities.

IMPROVED MILK COOLER.

Rollen C. Greene, Potsdam, N. Y., assignor to himself and Nathan P. Chaney, of same place.—This milk pan is so constructed as to enable the milk while in the pan to be cooled or warmed, as may be required. There is a top tank, a surrounding air chamber, and a bottom tank.

IMPROVED COFFEE ROASTER.

George W. Tinsley and Amandes Hackman, Blakesburg, Iowa.—This relates to an improved coffee roaster, by which the flavor of the coffee is fully retained, and the same roasted in convenient manner without interfering with the cooking operation of the stove. The invention consists of a drum with end pipes connecting with the stove opening and the chimney pipe, the drum having an interior heating cylinder with detachable heads, in which a revolving wire cloth cylinder is supported.

IMPROVED VAPOR BATH.

George W. Walker, Guy's Mills, Pa.—This consists of a boiler or vapor generator formed within a metallic cylinder, the lower portion of which is perforated and forms a receptacle for a lamp, while the upper portion is provided with a single row of perforations for distributing the vapor that issues from the central aperture of the boiler top.

IMPROVED GAS REGULATOR.

Samuel S. Jones, Norristown, Pa.—This device is so constructed that the consumption of gas may be economized, and, if desired, entirely interrupted at any one burner. It consists of a burner socket or base, with exterior threaded issuing tube and slotted cap or valve adjustable thereon. The valve is inclosed by a bulb-shaped outer part, to which the burner is attached.

IMPROVED STOVEPIPE DRUM.

Jacob Closs, Decatur, Ind.—The construction is such that no ashes can collect in the drum as they must fall through the heads, forming a part of the drum and back into the stove through the stovepipe. The advantages claimed are its efficiency in utilizing the greatest possible amount of heat, in controlling the draft, freedom from choking or clogging, and the facility with which the drum may be taken apart for cleaning or repairs.

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.

See our Advertisement. Parties writing please state what kind of machinery is wanted. Steptoe, McFarlan & Co., Cincinnati, O.

A foreign correspondent desires to obtain a Machine for making Round Matches; also a Dipping Machine. State prices; also how much power is required to run the match machine, whether it can be run by hand, etc. Address Munn & Co., this office.

For Sale—One 25 H. P. Horizontal Tubular Boiler, and one 25 H. P. Corliss Engine, both been run about 6 months. Kelly & Ludwig, 730 Filbert St. Philadelphia.

Shear Makers please send Illustrated Catalogues and Price List to J. L. S., Lock Box 5, Charleston, S. C.

"Champion Wind Power." Parties in unoccupied territory wishing to manufacture, under patents, address H. M. Underwood, Kenosha, Wis.

Wanted—Machine Shop, Foundry, and Boiler Works for large orders. G. Harden, P. O. Station A, N. Y.

Good Second-hand Steam Engine, cylinder 12 x 24 in.; flue boiler 40 in. x 25 ft.; smoke stack and connections complete; for sale cheap. C. S. Green, Roaring Branch, Lycoming Co., Pa.

Foundrymen, letter your patterns with Metallic letters made by H. W. Knight, Seneca Falls, N. Y.

Wanted—A No. 2 Pratt & Whitney Revolving Head Screw Machine, with Wire Feed and Chuck. Address Stanley Works, New Britain, Conn.

Wanted—Second-hand or new, 2 or 3 H. P. Portable Engine; must be good and cheap, full and complete. Description to H. M. Hill, Chancey, Mont.

For Sale—New Steam Launch, 30 x 8 feet; "fast;" Black walnut and Nickel finish; $1,200. S. E. Harthan, Worcester, Mass., Manuf. of Launches and Engines.

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

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Woodworking Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 12 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsaith & Co., Machine dealers, Manchester, N. J.

Wanted—Some Manuf'g Co. to manuf. a new, cheap, and efficient Steam Governor for Portable Engines. Correspondence solicited. Address J. W. Collet, Alton, Ill.

Combined Miller and Gear-Cutter; capacity large; almost new; a bargain. C. A. Conde & Co., Phila., Pa.

Thermometers and Hydrometers for scientific and other purposes. Goldbacher, 38 Fulton street, N. Y.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

Shaw's Noise-Quieting Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

"Abbe" Bolt, Forging Machines, and "Palmer" Power Hammers; best produced. Prices greatly reduced. Also sole builders Village and Town Combined Hand Fire Engines and Hose Carriages, $350. Send for circulars. Forsaith & Co., Manchester, N. H.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 40 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing Welles' Specialty Works, Chicago, Ill.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Leather and Rubber Belting, Packing, Hose, and Manufacturers' Supplies. Send for list. Greene, Tweed & Co., 18 Park place, N. Y.

Blake's Belt Studs.—The best and cheapest fastening for Rubber or Leather Belts. Greene, Tweed & Co., 18 Park place, N. Y.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Best Glass Oilers. Cody & Ruthven, Cincinnati, O.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 62.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

Notes & Queries

C. H. B. is referred to reply to W. G. F. (No. 25) in No. 3 present volume. About etching, see reply to C. H. B.—I. F. R. asks for a recipe for a depilatory, and is referred to Cooley's "Cyclopedia of Practical Receipts," p. 400.—W. H. T. had better correspond with some of the officers of the expedition to which he refers.—C. C. N.—For directions for preserving insects write to the Smithsonian Institute, Washington, D. C.—A. is informed that the power of a man is considered about one fifth of a horse power.—J. H. von H.—It would be better for you to obtain some article by advertising in our "Business and Personal" column.—J. H. W. will find the manipulation of nickel very much like working brass. He must learn by his own experience the adaptability of the metal to his wants.—R. W. S. can learn how to regulate heat by addressing J. N. Adams, Olathe, Kansas.—W. E. is answered thus: 1. Any earthen jar will do. 2. By burnishing with steel or bloodstone burnishers. 3. Leather called seahorse hide. —F. H. is informed that we see no particular objection to the present mode of making the wheels he refers to.—J. C. H. is referred to reply to L. O. B.—P. C. is informed that he is probably correct, as we understand his question.—J. G. R.—We can give no other information about the "new process" than that described in the newspaper articles that you enclosed.—P. N. is informed that the U. S. Government has made no such offer as he mentions.—H. R. had better consult works on astronomy for replies to his questions concerning the rotation of the earth, etc.—P. S. is informed that the publisher's price of Forney's work on the locomotive is $2.50.

(1) W. W. asks: How can I purify a whisky cask, so as to use the same for ice water and not have the water taste of the former contents? A. Wash with a strong solution of carbonate of soda in hot water mixed with some clean sand, and then with plenty of clean water. Or, after washing, fill with water and allow to stand for some time, and finally rinse thoroughly with clean water.

(2) G. H. W. asks: 1. Is manganese magnetic? A. When pure, no. 2. What is its value? A. Pyrolusite of good quality is quoted at ten dollars per ton in New York. 3. Does it pay to mine it when in large quantities? A. When of good quality, and the mines are so situated as to admit of cheap transportation, yes. 4. For what is it used? A. It is extensively used with salt for the production of chlorine for bleaching purposes, in the manufacture of glass, in paints, and dyes, as a source of oxygen, in some metallurgical operations, in the chemical laboratory, etc.

(3) T. J., of Toronto, asks: How long should wood require to be steamed before it will bend? What are the best kinds of hard wood for bending? A. The time depends upon the quality and form of the wood. No general rules can be given. Wood of recent growth is most readily bent. Hickory and ash are best.

(4) B. F. H. asks: 1. How large an engine, (oscillating) should I make for a boat 10 feet keel, 3 feet beam, 15 inch propellers, with a boiler 15 inches in diameter and 20 inches high? A. Cylinder 1½ by 2 inches. 2. How thick should sheet iron be for the boiler? How thick if made of copper? How much pressure will it stand? A. Iron ⅛, copper 3/32, pressure 75 lbs. 3. Do you think these dimensions are suitable for a boat of this size? A. They will answer very well.

(5) G. L. W. asks: What can be used for the purpose of making coal dust in block shape, and at the same time not destroy its burning qualities? A. There are numerous patented processes. You should apply to the inventors for information.

(6) S. H. M. asks: How large an engine and boiler do I need to run a boat 25 feet long and 6 feet beam? I want her for speed. How many will she carry? How large an oscillating engine must I have? A. Cylinder 4x6, boiler 3 feet diameter, 4 feet high. Such a boat can be made to carry 10 or 12 persons very comfortably, or more if desired.

(7) B. S. asks: What is the relative unity of resistance of an electric battery responding in a wire (Ohm's law) you refer to in your articles on telegraphy; is it the resistance in a copper wire or in a column of Hg of 1 yard in length? A. If we get your idea, the ohm or unit of electrical resistance is equal to the resistance of a prism of pure mercury, 41·7 inches in length, and ·001549 square inches section at 0° C. (= 32° Fah.) The internal resistance of batteries varies considerably. The resistance of conductors varies with their dimensions and temperature.

(8) M. P. asks: How much will a 20 horse power steam engine and boiler weigh, built of the best material? A. It will vary, according to the construction. A fair average will be about 8,000 lbs.

(9) N. P. M. asks: Will you tell me how to straighten two small, seasoned red cedar poles, of which I wish to make two canes? These sticks are valuable as souvenirs, and I wish to make them useful. A. It will probably be necessary to soften them by degrees, securing them in the successive positions.

(10) A. B. asks: Can you give me a description of how to make a good, cheap, sluice or rocker for washing gold out of gravel and surface dirt? A. We could not do the subject justice in this limited space. You should consult some standard work. The method practiced in Japan, which seems to be cheap and efficient, is described by Henry S. Munroe, E.M., in a pamphlet entitled "The Gold Fields of Yesso."

(11) C. R. B. says: A combined barometer and thermometer is now sold, the barometer tube containing a fluid which, when rain approaches, hardens and resembles ice. Are such barometers reliable weather indicators? What is the fluid used? A. They are not very reliable. Sometimes a solution of camphor is used, we believe.

(12) E. S. Y. says: We have two shafts parallel with each other. We wish to make the driver shaft do more work. A friend says increase the diameter of the pulleys. I say increase the width of the belt. He says it will convey more power with the same belt by increasing the pulleys ½. Which is right? A. You are both right.

(13) W. W. H. asks: What power does a reflector add to light? A. It concentrates the light.

(14) S. W. M. asks: What is best to paint a steam boiler and smokestack with, so that it will stand heat? A. Black varnish made from petroleum answers very well.

(15) G. F. says: A person seems to be under mesmeristic influence of a person they have not seen for two years. Can they be freed from such influence? A. We are not sufficiently familiar with the facts to enable us to answer the question.

Will a pulley covered with leather pull more than one of cast iron, perfectly smooth? If so, why? A. Generally, yes; because the co-efficient of friction is greater.

(16) G. M. B. asks: Will a boiler steam as fast (with the same fuel) with the water at the upper cock as it will with water at first cock, and why? A. In the majority of cases there will be no great difference, other things being equal.

Is the sting of a locust poisonous? A. Troublesome, but not fatal, we believe.

(17) J. W. F. S. asks: 1. If the stamps upon letters passing through the post were canceled, in the same way or with the same material as the stamps themselves are printed with, would it not be impossible to remove the cancelling without so far destroying the stamp itself as to remove all danger of its being used again? A. This method has been suggested before, but there is a difficulty in the way of properly using these inks with hand stamps.

Would the addition of salt to the water used for watering streets render it more effectual? A. Yes, but it is claimed to be unhealthy, and is injurious to the feet of horses.

(18) N. S. B. & Co., Ottawa, asks: What are the proper dimensions of a steam yacht between 35 and 40 feet long? And what size engine would be required to run her? A. You will find the required information in Nos. 69 and 81 of the SCIENTIFIC AMERICAN SUPPLEMENT.

(19) C. G. H. asks: What will remove the stain of nitric acid from black woolen goods? A. Wash with a strong hot solution (in water) of carbonate of ammonia. If this does not remove the stain it may be concluded that the acid has destroyed the coloring matter. This is usually the case. If the yellow stain remains, the only remedy will be to re-dye the material.

(20) I. E. R. says: I would like the latest and best books describing the diamond fields of the world? A. See article on the subject in SCIENCE RECORD for 1874. The works of Castellani and Emanuel on gems, diamonds, and precious stones may be of value. The American News Company of New York city, in 1872 published a work oh "The Diamond Fields of South Africa."

(21) E. C. H. asks how to cast a box on a bearing, and is answered by a correspondent thus: My plan is to give the journal a heavy coat of smoke, by holding it over fire of bituminous coal. While being smoked it is also becoming hot. I have filled a box on a inch and a quarter screw, square thread, four to the inch, four inches long, and had no difficulty in running it off from the screw after being cast.

(22) C. P. says: Where can I obtain information for building a machine for making ice? A. See reply to F. A. R. (No. 47) in No. 3 present volume SCIENTIFIC AMERICAN.

(23) F. S. C. says: Can you give me an analysis of the water of the Atlantic Ocean? A. The following is an analysis of sea water from the British coast: Potassium chloride ·766, sodium chloride 27·959, ammonium chloride, trace; calcium chloride, 3·666; sodium bromide, ·029; sodium iodide, trace; calcium sulphate, 1·406; magnesium sulphate, 2·296; calcium carbonate, ·033. Your second question, concerning a discrepancy in an analysis of water from Richfield Springs, we do not understand. We cannot give you the address of the professor mentioned.

(24) W. D. S. is informed that, provided the metals are brought into proper contact, it matters little whether the amalgamation takes place in the presence of water or not. Where the auriferous sand or dust from the quartz mill is emptied directly into the mercury, the amalgamation at best is very incomplete, and the mercury adhering to the dust occasions a great waste. Under such conditions the mercury becomes grossly contaminated, and is likely to yield an impure product in the retort.

(25) G. S. says: I cannot succeed in covering Smee battery plates (silver) with an equal coat of black oxide of platinum. I tried several ways, but fail to get an equal color. Also whether the platinum coating must be very dark, or if a grayish looking coat is sufficient? A. Dissolve chloride of platinum in about 100 parts of cold water. In this immerse the silver plate, and connect it by means of a wire with the zinc pole of a small battery. Then connect the positive pole of a battery with a small rod of clean carbon, also immersed in the platinum solution. Or a small porous cup containing a rod of zinc and water very slightly acidulated with muriatic acid may be used in place of the carbon anode; then, on joining the zinc and silver with a copper wire the platinum will be deposited on the silver as a black or grayish-black rough coating. The silver plate must be perfectly clean to secure a good deposit.

(26) A. P. H. says, in reply to casting box for shaft: Take the mandril out, wipe off all the grease, and then smoke the bearing in the blaze of a candle or lamp till it is covered with lampblack, then lay it in the boxes in the way it wants to run, and fit a piece of thin wood or board to the shaft on each side of the boxes, to keep the metal from running out, then moisten some bread to a paste and paste it in the cracks between the mandril and wood on outside of box. Put some paper between the upper and lower box tight to the shaft, to keep the two halves of the casting separate. Pour the metal through the oil hole.

(27) C. C. asks: How is nitro-benzole made? A. Nitro-benzole is commonly prepared by adding benzole carefully to a cooled mixture of equal parts of strong sulphuric and nitric acids. This solution, when largely diluted with water, yields a precipitate of the nitro-benzole. It is used to some extent by perfumers as a substitute for the more costly oil of bitter almonds, which it closely resembles in odor. It is also used for the preparation of anilin. It can be obtained from almost any large chemical establishment. The price of the purest preparation is about a dollar per ounce. In unskillful hands its preparation is somewhat hazardous.

(28) G. W. asks: 1. What will be the result if a tight vessel is filled with steam at 4 lbs. pressure to the square inch, and a gauge mounted thereon, then surround this vessel by another one, and let steam at 60 lbs. pressure into it, and around first-named vessel. Will the pressure in first-named vessel rise, and if so, to what height of gauge? A. The pressure will be slightly increased. 2. Will steam absorb heat as freely as it absorbs cold, or is it capable of absorbing heat with more rapidity than the water of the boiler in which it was generated? A. We think not, as we understand the question.

(29) L. O'B. writes: We have a well situated 650 feet from an outlet, the connection is a siphon of ¾ gallon pipe. From the surface of the water to the highest point it is 15 feet; then the pipe runs nearly level, a distance of 500 feet, when it makes a steep descent to the outlet, which is 10 feet lower than the level of water in the well. After laying the pipe, we pumped out the air, and the water ran for about 8 or 10 hours (going slower all the time) until the stream was only about ¼ inch, which would run for two days or more. Thinking there might be a leakage, we tested the pipe to 60 lbs. hydraulic, but found none. Then after starting the water nicely, we stopped the outlet for 14 hours; on opening, the water ran as before (a good stream at first) the same as when we first pumped it through. Now the questions are: What is the disease? and what is the remedy? A. The trouble is probably caused by the accumulation of air at the highest point, and the remedy is to attach a cock or valve for removing it.

(30) G. W. B. says: I am desirous of attempting to hatch eggs artificially, on a small scale. Can you describe an apparatus with which I can hatch say 100 or 200 at a time? At what temperature must the eggs be kept? In what position, and how often turned over? A. There are many details required for a successful apparatus, which we could not describe in this limited space. Now as you are willing to incur considerable expense in experiments, it will be better for you to inspect some establishment that is in successful operation.

(31) G. W. W. says: Given the plane of view, or delineating plane, perpendicular to the plane of the equator. Required to draw a map of the earth, showing parallels of latitude and meridian lines, the point of sight being outside of the earth and on a line passing through the center of the earth and perpendicular to the plane of delineation. The equator and the meridian line in the plane perpendicular to the plane of view will be represented as straight lines. How are all the other circles of longitude and latitude to be drawn, as arcs of circles or ellipses? If either, why, and how are they determined? A. You should consult a treatise on map projection.

What is the highest horse power to which the force of electricity has been made to work? A. There is scarcely any limit in the modern machines.

(32) H. F. L. says: I bored a well for a steamship company, some 2 miles out in Humboldt Bay. We struck a vein of burning gas at 86 feet. At 114 feet struck good fresh water for drinking and cooking, which is used by the vessels; but they say they cannot make steam of it. When heated it rises in white foam. Can you tell how it can be used for steam, or what is the cause of it? A. We need some more particulars to enable us to explain this. Possibly others who are familiar with the matter will send communications.

(33) C. R., Appingedam, asks: I have a smoke stack of 65 feet, and use as fuel wood waste from the planing mill; the sparks, or rather the burning wood chips cause accidentally fire in the yard or the neighborhood. What is the remedy? A. We imagine you can stop this in a great measure by the use of a spark arrester made of wire cloth, such as is made for a wood-burning locomotive. The number to which you refer is out of print.

(34) E. D. E. asks: 1. At what temper (by color) will steel bear the greatest tensile strain? A. Generally at a low temper. 2. Is iron tempered after it has been case-hardened? A. No.

I have a 3" x 4" vertical engine, cutting off at about ¾ stroke. What size of boat, and what diameter and pitch of a three-bladed propeller will it run with 80 lbs. of steam? What size of boiler will it require, and will a 2" plunger with a ½" stroke, attached to main shaft of engine, feed it? If not, what size will? A. Boat 22 feet long, propeller 2 feet in diameter 3 feet pitch. Boiler 26 inches in diameter 3½ feet high. It would be better to use a pump of twice the above capacity.

(35) W. E. B. says: Our house is overrun with cockroaches. We have tried two kinds of poison and have done no good. A. Mix fine plaster of Paris with double its weight of oatmeal and a little sugar. Strew this on the floor or in the chinks where they frequent. This is less objectionable than Paris green, and accomplishes its purpose nearly as well. Sumac leaves dried, ground to a fine powder, and, with a little blow-gun, driven into the crevices is certain and speedy in its work. Tannic acid mixed with a little lime may be used in a similar manner. A mixture of one part oxalic acid, one of sugar of lead, three of finely ground oak-bark, and a little flour, is also recommended. Kerosene, petroleum, turpentine, etc., are also fatal to these animals.

(36) J. V. R. asks: What is the essential difference between a magneto-electric machine for light

giving purposes, and one for electro-plating? A. Ordinarily there is little or no difference. In some of the Ladd and Gramme machines used for plating, arrangements are made so as to alter the quantity of the current and to admit the use of only a fraction, or all of it, as desired.

(37) A. P. F. says: I wish a recipe that will thoroughly water and mildew proof cotton canvas, and which will not injure the fabric when exposed to 280° of heat for 30 minutes. A. We think it will be difficult to devise a method that will, with any degree of satisfaction, answer all your requirements. Strong, hot solutions of alum or pyroligneate of iron (iron liquor) may be used to render such material mildew proof, and, if subsequently boiled in a strong solution of rosin soap, the cloth will be made reasonably waterproof, by the formation of insoluble alum soap or iron soap in the fiber.

(38) J. D. W. asks: How can I prepare sulpho-carbonate of potassium? A. It may be prepared by digesting for a few hours potassium sulphide with a slight excess of carbon disulphide, then adding a little water, and evaporating the whole dearly to dryness over a water bath.

(39) H. L. B. asks for a recipe for crystalizing tin plate. A. Wash the surface of the plate, previously warmed, with dilute nitric acid (1 of acid to 2 of water). As soon as the crystalline appearance is fully developed, wash it thoroughly in running water, dry, and varnish. 2. Please give me a recipe for turning tin blue and other colors? A. Tin cannot be stained or colored other than by paints or colored varnishes, etc. Use a filtered alcoholic solution of bleached shellac, colored to suit with any of the aniline colors. Very beautiful effects may thus be produced, as these colors are very real and transparent.

(40) H. E. W. asks: 1. Where can electric pile referred to in SCIENTIFIC AMERICAN of January 22, 1876, on p. 55, be found? A. The battery, we believe, is in the market. See our advertising columns of addresses of electricians. 2. Is it patented? A. Yes. 3. What effect does the peroxide of manganese in porous cell of Leclanché have on the carbon? A. It has no effect on the carbon—it serves to oxidize into water the hydrogen liberated at that pile. 4. What is the object of pounded carbon in the cell, and how much oxide is there in it? A. The carbon serves to decrease the internal resistance of the battery. The proportion of carbon and manganic oxide is variable, but may be about 1 part of the former to 3 of the latter. 5. Does the ammonium chloride in outer cell unite with the manganese and form an acid? If so, why? A. No; when circuit is closed the zinc dissolves in the ammonium chloride, forming ammonio-chloride of zinc. 6. What compound will unite with chloride sodium and form an acid? A. There can be no such reaction.

(41) C. L. P. asks: How does the fly walk on the ceiling? A. The flies' feet are provided with small, hairy, inverted cup-shaped cavities, capable of distending when pressed on a smooth surface, so as to form a slight vacuum, after the manner of the sucker. See "Hogg on the Microscope."

(42) G. C. asks: Is there a process for coating the fibers of cotton with silk? A. We know of none.

(43) W. E. asks: 1. What kind of a brush or buff do they use in the silver plating factories to put on the high finish on plated ware? A. It is done by burnishing. 2. Is there any other way to clean goods for plating besides scouring them with pumicestone and brush? A. Yes, by filing, scraping, and pickling in acids. 3. I would like to know about the patent on nickel plating? A. We refer you to the patentees.

1. What is the best way to clean brass bird cages? A. Wash with soap and water or a weak alkali. 2. What kind of varnish is put on to make them look so well? A. Shellac varnish can be used.

(44) T. A. P. asks: It is claimed that certain base-ball pitchers are able to throw a ball so that it will describe a horizontal curve in the air. Is such a thing possible, with a perfectly spherical ball and in a still atmosphere? A. We have never seen it done.

(45) H. D. E. asks: How is paper powder made? A. You will find information in No. 21, vol. 36. The proportions of the ingredients we cannot give.

(46) O. G. B. asks: What are roller skates, and are they patented? A. They are made something like a pair of sandals, but with rollers in place of skate irons. There have been some patents granted on them.

Could a copyright be obtained for a plan for organizing a society so that no society could make use of it without the consent of the owner of the copyright? A. Yes.

How much force could a spring, similar to the spring in a spring clock, be made to overcome? For instance, could one be made to wind up like the spring of a clock that would exert a force of 1,000 lbs., or 500 lbs., or any given number of lbs.? A. Yes.

Could a patent be obtained on a new plan for a lottery wheel or other contrivance for the purpose of lottery drawing? A. Yes.

Will any regularly organized order, having by-laws and officers, have to be chartered by the State? A. Consult your State statutes.

Is a raw cowhide, as it is taken from the brute, impenetrable to water? A. Yes.

(47) A. C. S. asks: What compound is used for making patent leather? Also how is it applied to get such a perfectly smooth surface? How long should it be boiled to give it the drying quality that boiled oil possesses? A. Patent or enamelled leather is prepared from hides that have passed through two operations; the first to render the leather impermeable to the varnish, and the latter to lay on the varnish. The hides are rubbed on the grain side with three coatings of boiled linseed oil mixed with ocher or ground chalk, and dried after each coating. The surface is then pumiced, and treated with general applications of the same material of a thinner quality. Over the surface so prepared are laid successive layers of boiled linseed oil, and of the oil mixed with lampblack and turpentine spread on with a brush. The surface, which has become black and shining, is then varnished with copal and linseed oil with coloring matters. The following is recommended: Boiled linseed oil and turpentine 20 lbs. each, thick copal varnish 10 lbs. and 1 lb. each of asphaltum, Prussian blue, or ivory black. Five coats of varnish are successively applied, and the colors are varied at will. Oil should be boiled until all the moisture is expelled.

(48) F. H. D. & Co. ask: Will you give me recipe for making a marking pencil for lumbermen, or marking packages? A. A perusal of the article on "Pencils" in Knight's "Mechanical Dictionary" (part 25), will probably give you the information.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

W. W.—If minerals in slate pencil box are yours, they are: No. 1, mispickle, sulphide, and arsenide of iron. No. 2 is limonite—an iron ore. No. 4 is tennantite, or sulphide of iron, copper, and arsenic. The green piece is a hydrous arsenate of copper—tyrolite. No 5 contains antimony, iron, and silver.—E. A. S.—It is magnetic iron pyrites—pyrrhotine. It may contain more valuable metals.—J. E.—(Minerals in tin box). They contain silicates of alumina, magnesia, potash, and soda, sulphate of lime, and carbonate of lime. They do not necessarily indicate the proximity of coal or oil. Limestones are very common in oil regions.—M. S.—No. 2 is calcite. No. 5 contains galena—sulphide of lead. No. 6, the irridiated brassy-colored piece is chalcopyrite—sulphide of copper and iron. No. 7 contains iron and copper pyrites, oxide of iron, and a little carbonate of copper. No. 9 is amianthus. No. 10 is quartzose rock with pyrites. No. 11 is magnetic oxide of iron. No. 12 is clay slate with oxides of iron. No. 13 contains galena and probably silver. No. 14 is augite. No. 16 is galena. No. 17 is mica-schist. No. 18 crystals of carbonate of lime. No. 21 is a clay with much oxide of iron. Nos. 1, 3, 4, 8, 19 and 20, are missing.—F., of Curaçao, South America.—The sample of pitchy material sent was probably formed by the evaporation of the more volatile constituents of a petroleum. It contains a large percentage of earthy impurities. It is probable that higher up the ravine referred to a more valuable oil may be obtained. Its commercial value could be definitely determined by an analysis. Its destructive distillation will yield a very rich illuminating gas. It probably contains some paraffin.

COMMUNICATIONS RECEIVED.

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

On Boiler Joints. By F. G. W.
On Snakes Catching Fish. By E. A. P.
On Hog Cholera. By ——.
On Submarine Torpedoes. By ——.
On an Apparatus for Analyzing Polarized Light. By W. L.
On the Brown Bat. By C. F. S.
On the Seventeen Year Locust. By R. K. S.
On a Telephone. By N. T. McK.
On a Tidal Motor. By A. S.

Also inquiries and answers from the following:

S. A. S.—F. P.—C. F. M.—P. N.—E. A. S.—D. B.—M. H. M.—A. I. F.—C. B. L.

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 makes paper balloons? Who makes assays of minerals? Who deals in canary birds?" 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.

INDEX OF INVENTIONS

FOR WHICH

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June 19, 1877,

AND EACH BEARING THAT DATE.

[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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10,055.—CENTER PIECE.—A. Carlewitz, Newark, N. J.
10,056.—CASSIMERES.—C. F. Harrison, New York city.
10,057.—STAIR CARPET TACKS.—M. Krickl, N. Y. city.
10,058.—FANCY CASSIMERES.—P. McGee, Blackstone, Mass.
10,059.—PICTURE FRAME.—R. C. Mitchell, Aurora, Ind.
10,060.—COOKING RANGES.—T. H. Roberts, Detroit, Mich.
10,061.—STUCCO CENTER PIECE.—P. A. Stout, Allegheny, Pa.
10,062.—TRIMMING.—R. Werner, Hoboken, N. J.
10,063.—TOBACCO BAGS.—W. J. Cussen, Richmond, Va.
10,064 to 10,066.—OIL CLOTH.—C. T. Meyer *et al.*, Bergen, N. J.
10,067.—FLOWER STANDS.—H. P. Roberts, Tunkhannock, Pa.

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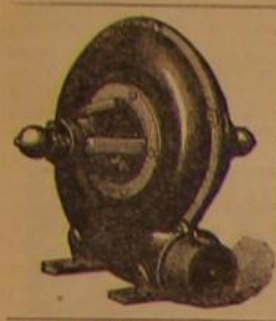
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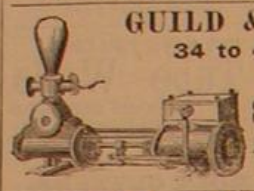
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