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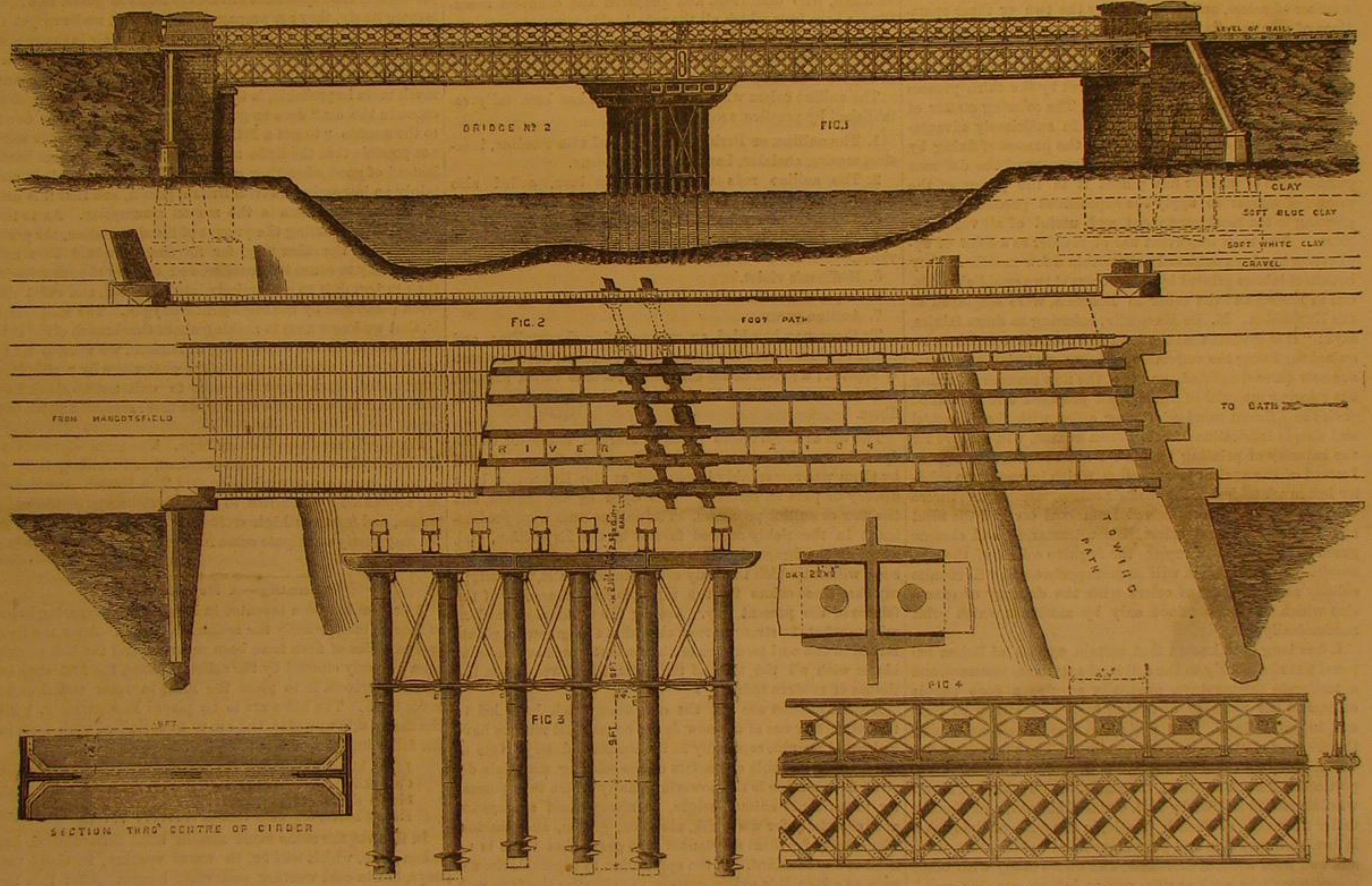
Iron Railway Bridge over the Avon.

We copy from the *Engineer* an engraving and description of one of six bridges over the Avon on the Mangotsfield and Bath branch of the Midland Railway. They are supported in the centre on cast iron screw piles. The engravings represent the bridge known as No. 2. It rests on abutment piers at each end; the middle pier is formed of a stack of twelve piles, which have screw blades prepared on a special system by Messrs. Handyside & Co., of Derby, who supplied and constructed all the six bridges. The superstructure consists of fourteen lattice girders, which, with their bracings, weigh 218



BRIDGE ON THE MIDLAND RAILWAY OVER THE AVON NEAR BRISTOL, ENGLAND.

tuns. The piles weigh sixty-six tuns, and the girders by which they are united at the top, and the centrals carrying the superstructure, weigh forty-one tuns. The main girders are surmounted by a handsome open railing.

Referring to our engraving, we have at Fig. 1 an elevation of bridge No. 2; and at Fig. 2 a plan, with a portion of the platform removed, and showing also a footway beyond the lines of rails. Fig. 3 shows an elevation of the screw piles, which are two feet diameter, and are filled in with concrete. Fig. 4 shows the parapet railing in elevation and detail, from which will be seen its connection to the main girder.

It may be as well, before concluding, to say a few words upon the manner in which the screw piles of these bridges were fixed. In some instances they pass through beds of rock from ten inches to twelve inches thick, and in all cases they passed through blue lias and red clay. Each pile was held in place while being screwed down by a strong timber framing. Instead, however, of the usual capstan, rope, and winch arrangement for screwing, Messrs. Handyside use a special apparatus of their own design. Having experienced the difficulty of keeping the two ends of an elastic rope equally taut, and finding, moreover, that the winches were sometimes unable to exert sufficient power, they devised a machine by which both ropes and winches are dispensed with. It consists of an arrangement of worm wheels and gearing, and admirably overcomes all the difficulties of the ordinary system, and prevents those occasional jerks which are so undesirable in the operation of screwing. All the six bridges were designed by Mr. J. S. Crossley, the engineer to the Midland Railway Company; their supply and construction being intrusted by Messrs. Eckarsley and Baylis, the contractors for the line, to Messrs. Handyside & Co., to whom we are indebted for drawings and particulars. Although there are no strictly novel features about these bridges they deserve attention as examples of the best modern practice. We need scarcely add that the workmanship is excellent.

Xylography, or Printing and Graining from the Natural Surface of the Wood.

A new method for graining has been recently patented in England, applicable to transferring impressions from wood to plain deal, or to painted surfaces, either flat or molded, in buildings of all descriptions, where an accurate transcript of the more costly woods is desired, and for house and bedroom furniture generally; for japanned goods, made in metal or *papier maché*; for enameled parqueterie tiles, and for articles in earthenware, such as garden seats, oyster and flower tubs, spirit casks, flower pots, tea-urn stands, etc.; for enameled slate, for paper hangings, and for oil cloths.

The inventor thus describes the process. Select a piece of wood of fine quality, about five feet long, twelve inches wide, and one-fourth inch thick; it is, to use the technical phrase, cleaned up by the cabinet maker on both sides, and is well sand-papered down. By having both sides of the board cleaned up, two patterns are obtained from the same board. A chemical preparation is then applied to it, which has the effect of opening the pores of the wood, and, at the same time, of hardening the surface, and, when the board is thoroughly dry, it is ready for use, and is, in fact, a wood plate, "not graven by art or man's device," but by the great Designer and Architect of the universe, whose works, the most stupendous as well as the most minute, are all perfect. The material used for taking the impression is prepared in oil, and is specially adapted for the purposes of transferring. The paper, too, manufactured for the purpose, is very thin but tough, so that it can be successfully applied to any irregular or molded surfaces, and it is sized to prevent the color from becoming incorporated with the body of the paper. A small wood roller is used for spreading the color on the board, and a large, broad, flexible palette knife is used for taking the superfluous color off. That being done, the sized paper is placed on the board, and both are passed through a small machine having turned iron cylinders, the upper one being covered with double-milled flannel; the paper is then taken off the board, its printed surface is applied to the article to be decorated, the back of the impression is lightly rubbed with a piece of soft flannel, the paper is removed, and an exact *fac simile* of the board, from which the impression is taken, is given. But that is not all, for a second and a third transfer are frequently obtained from the same piece of paper, and sometimes a fourth, a fifth, and a sixth. This is one of the remarkable features of the process, and, as you will not fail to perceive, must have a very marked influence on the rapidity of its application, and, consequently, on its cheapness. With the color properly prepared, and adapted for its purpose, the plate does not clog or become foul any more than does the plate of the copper and steel-plate printer; but such a result would occur in both cases if the material used was not suitable for its purpose. When a board has been used it is treated as all other plates are, a cheap material is used for dissolving the printing color, a handful of fine sawdust is then rubbed over it, which most effectually draws out of the pores of the wood the dissolved color, and leaves the board clean, and ready for further use when required. Under the same conditions, provided no accident happens to it, the board will be far more durable than either the copper or steel plate.

Charcoal Pipes.

The use of charcoal in the preparation of pipe heads, a long time practiced, has lately experienced many improvements, so that now pipes are produced remarkable for a deep black, lustrous appearance, and of very great durability. The material consists of a mixture of two parts of the best charcoal black and one part of the best black peaty earth, ground so finely that, when rubbed between the fingers, no trace of granules is perceptible. Two parts of this mixture are then united with one part of an equally well pulverized residuum of distilled cannel coal, containing still a portion of its bitumen, and the whole rubbed together thoroughly till all the three ingredients are uniformly combined. The mixture is then placed in iron boxes, in which are sunken molds corresponding to the pipe heads, and while the boxes are then heated to the boiling point of water, stamps with rough surfaces are pressed under hydraulic pressure into the openings of the heads, so that this process, united with the increased temperature, not only combines the carbonaceous mass into compact pipe heads, but also produces a smooth exterior, and at the same time a rough inner surface.

DYEING IN FRANCE AND CONTRIBUTIONS OF MODERN SCIENCE TO THE ART.

BY E. B. MUDGE U. S. COMMISSIONER TO THE PARIS UNIVERSAL EXPOSITION OF 1867.

(Concluded from page 194.)

The advantages resulting from the recent improvements, by which the coloring matter of madder is obtained in a purer and more concentrated form, will be rendered more obvious by a brief statement of the usual processes in printing. These may be divided into three different classes: First, where the colors are fixed without a mordant, as in dyeing blue with indigo, either of a uniform tint, or where the whites are reserved by an application which prevents the contact of the dye upon the parts to remain uncolored. Second, where mordants are first printed upon the tissues, which are afterward subjected to subsequent operations of tinctures, as by immersion in the dying liquid, etc. This process, until very recently, has been necessary for all madder dyes. Third, where the mordants and coloring matters are previously combined together to form the color to be impressed, which is called a "color of application." In this last class of processes the printed tissues are suspended in a vessel filled with steam from boiling water, which produces the same effect as dyeing by immersion in a liquid bath, the colors combining directly with the fibers of the tissues. By means of the steaming process, the operator can print and fix at once an indefinite number of colors, and terminate by the two or three operations of printing, fixing, and washing, a work which formerly required many weeks when accomplished by the process of dyeing after the printing with mordants; almost all the coloring materials known could be fixed by the third process upon tissues of wool, silk, or cotton. The coloring matter of madder alone has not been isolated in sufficiently advantageous conditions of assimilation, that the process of fixing by steam could be applied to it. The discovery of the different purifications of madder has placed it in the power of the printer of tissues to apply the expeditious process of steam printing to the most permanent and useful of all vegetable colors. The most important use of madder as a color of application has been achieved only within a few months. Very beautiful fabrics printed by this process at two establishments, one in France and the other in Bohemia, were displayed at the Exposition. M. De Kaeppilin, referring to these fabrics, says: "It is evident that the long and difficult operations required for fixing the vegetable coloring material on tissues are now quite simplified, and that the new manner of fixing the coloring material of madder, all prepared and combined with the different mordants, being allied with the beautiful and simple fabrication of colors from aniline, will achieve for the industry of printing tissues its most beautiful conquest. Instead of the ancient steam colors, which in respect to solidity left much to desire, the madder colors, married as it were with the brilliant colors derived from coal tar and the solid and resistant mineral colors, like ultramarine and chrome green of Guignet, will replace the fugitive colors of the dye woods. The fabrication will be more perfect, and will reunite solidity and brilliancy of colors with the delicacy of execution which can be obtained only by machines which print mechanically."

It has long been known that certain species of lichen exposed simultaneously to the action of ammonia, moisture, and a moderate temperature, gradually acquire a deep purple color, and the property of dyeing wool and silk with pure and brilliant tints. The pasty and woody mass containing the coloring matter is known as cudbear. The coloring matter extracted by means of an alkali, and separated from the woody portions is known as archil, or *orseille*. A new kind of archil was introduced in 1856 by MM. Guinon, Marnas, and Bonnet, under the name of French purple, in the form of lime lake. It furnishes very fine and pure mauve and dahlia tints upon silk and wool without mordants, and mixes easily with other coloring matters, such as ultramarine, indigo, carmine, cochineal, aniline red, etc., producing the most varied and delicate tints. The manufacture of French purple, although at one time extensively prosecuted, has been greatly diminished in importance by the competition of the coal-tar purple.

In 1854, MM. Hartmann and Cordillet succeeded in fixing upon fabrics the green coloring matter of leaves. In 1851 and 1852 the famous Chinese green, called *Lo-kao*, was introduced. Subsequently, M. Charven, of Lyons, obtained the coloring principle of the *Lo-kao* from a weed indigenous to Europe, the *Rhamnus catharticus*, for which he received a gold medal. The Chinese green was especially admired on account of the beautiful green shades which the fabrics dyed with it assumed in artificial light. MM. Guinon, Marnas, and Bonnet discovered the means of producing at less cost shades of green which preserve their character under artificial light by the use of Prussian blue with picric acid. It is a curious fact that, while the greens produced by indigo and picric acid appear blue in artificial light, the dyes produced by Prussian blue and picric acid appear green.

A remarkable and very beautiful amaranthine red was first commercially prepared from uric acid in 1856. This dye, called *murexide*, created a great sensation, but its use was of short duration, as a more vivid and more easily applied tint was about this time obtained from aniline, and the murexide was objectionable because the color, though unaffected by the sun, was destroyed by sulphurous fumes, as in the atmosphere of London, impregnated with sulphur from coal. This coloring material is peculiarly interesting from the circumstance that it is nearly identical in composition with the ancient purple derived from the murex. Professor Hoffman records, as he shared, the triumph which was felt in Liebig's laboratory when a few grains of this substance were first obtained in a state of purity, and the rapidity with which the scientific discovery was made practical in the arts. When the manufacture reached its culminating point, the weekly yield of murexide in one factory only amounted to no less than 12 cwt., a quantity in the production of which 12 tuns of guano were consumed.

The long-sought-for rediscovery of the Tyrian dye was hardly attained before it was replaced by a product of modern science. The year 1856 was remarkable in the history of dyeing as the epoch of the most complete revolution of the art. It was the period of the practical discovery of the first aniline colors. The property which aniline, a product from the hydrocarbons of the coal series, possesses of forming colored compounds, was indicated by Runge in 1856. This indication was followed by the discovery by a young English chemist, named Perkins, of the means of preparing commercially from aniline a coloring substance of great intensity of hue and permanency, which is known in the arts as the "Perkins violet." This was almost immediately followed by the commercial preparation in France, by Verguin, of the aniline red. The extraordinary qualities of these products, the wonderful facility with which they could be applied to wool and silk, and the freshness and vividness of their hues, stimulated the scientific and practical chemists in France and England to search for new compounds from the same source, and to cheapen the production of those known. The most important scientific results were obtained by the English chemist Hoffman, who discovered and prepared the colorless rosaniline, a base from which all the reds, beside many other colors, may be formed, by different reagents. The colors derived the hydrocarbons of the coal series are as various and as vivid as the hues of the flowers.

The aniline colors whose use in the arts has been fully established by practice, are:

1. The aniline, or Perkins violet, called also rosaline, indesine, mauve, aneleine, hamaline, and violene.
2. The aniline reds with a rosaline base, called also fuschine, azaleine, and magenta.
3. The blues of rosanaline, Lyons blue, blue *de lumiere*.
4. The rosaniline violets, different in hue from the Perkins violet.
5. Hoffman's violet.
6. Imperial dahlia.
7. Aniline green.

To these may be added an orange color, chrysaniline, and colors produced from the oxidization of aniline, but not directly applied; a green called emeraldine, a blue called azurine, and the intense aniline black, developed only on vegetable fibers.

The use of these colors gives a marked character to the dyed tissues of the present age. The great change effected by them was remarkably illustrated at the Exposition by a display of parallel series of wools dyed by the ancient, and the new or aniline processes. The aniline hues were predominant in the richly colored fabrics of the Exposition, and, adopting the figure of Colbert, that "color is the soul of tissues, without which the body could scarcely exist," we might say that these colors fix the physiological character of the fabrics of the present day. Among the wonders of modern science what is stranger than this, that the gigantic plants buried in the coal measures of the ancient world are made to bloom with all the tints of the primeval flowers, upon the tissues of modern industry?

Artistic reasons are not the only ones which have led to the prevailing use of the new dyes; economical reasons have had equal weight, especially in the woolen industry. One of the most remarkable characters of the coloring materials derived from aniline is the powerful affinity which they possess for materials of animal origin, or nitrogenized substances, and especially for wool, silk, albumen, gluten, and caseine. The affinity for these substances is so great that there is no need of any mordant. In the application to vegetable tissues, such as cotton, it is only necessary to animalize the fiber with albumen. These colors may not only be applied with the greatest facility in dyeing by immersion, but add vastly to the economy of printing mousselines or calicoes, as they may be used as "colors of application" in steam printing. Beside, all these colors are now sold commercially in a state of great purity, and very often in crystals. The colorist has rarely anything more to do than to dissolve the product in a suitable vehicle, and to put it in presence of the fiber, in the conditions in which it can adhere, which for wool and silk are extremely simple.

The great problem in the art which science has now to resolve is to give more stability of color to these magnificent products of modern chemistry. The chemist who has furnished many of the facts above given, M. De Kaeppilin, is hopeful that this will be accomplished. He says: "Some of these results have already been obtained; above all, upon tissues of wool and silk. It is evident that colors derived from archills, such as the violets and reds, are more fugitive than the Perkins violet or new violets from rosaniline of Pourier and Chappal; that the roses of safflower or cochineal are not more stable than the roses of aniline, and that aniline black is not only superior to all other blacks, but that it is wholly unalterable and of complete stability upon tissues of cotton."

Before closing this imperfect review of the relation of chemical arts to the woolen industry, it is due to American science to observe that the name of the lamented Dr. Dana, of Lowell, is most honorably mentioned by French savans among those who have rendered important service to the art of dyeing and printing tissues. The credit is awarded to him of the introduction of lime in the operation of bleaching for the purpose of saponifying the fatty matter contained in the crude tissues. He thus completed the great discovery of Berthollet of the bleaching qualities of chlorine.

GENERATION OF OZONE IN THE ATMOSPHERE.

BY C. W. HEATON, PROFESSOR OF CHEMISTRY IN CHARING CROSS HOSPITAL COLLEGE, ENGLAND.

As to the mode in which ozone is generated in the air, we have only probabilities to guide us. There can hardly be a doubt that it is formed to some extent by the agency of lightning, and it is possible that this is the sole mode of its production. Some writers assert and some deny that it is present in the oxygen evolved by plants under the influence of light, but though such a formation is probable enough, the evidence both for and against it, is at present inconclusive, and lastly, it is possible, though still unproved, that it may be formed during some of the processes of slow oxidation which are so common on our globe.

However it is formed, it is at least certain that ozone exists in the air, and that, though small in quantity, it must, from its extraordinary activity, have important functions to fulfill in nature. But this very certainty has, unfortunately, been a fruitful source of wild assumptions and mere speculative guesses, doing infinite harm to the progress of true knowledge. Some have asserted, and have attempted to prove by perfectly inconclusive reasoning, that ozone arrests infection, and destroys the germs of epidemic disease. It is highly probable that such is the case, and it is certain that its presence is incompatible with that of many noxious gases. But then it is *not* certain that epidemics are due to noxious gases, and if, as is more likely, they are propagated by spores, we have yet to prove that the minute trace of ozone in the air is capable of destroying those spores. We can no more assume it than we could assume that it killed birds. Even more vague, and much more improbable, is the floating notion that an excess of ozone in the air "does us good." Men talk of running down to the seaside "to get a little more ozone," just as if it were not possible that the little more ozone might do them harm instead of good when they got it. In large quantity it is certainly an intensely powerful irritant poison, and that it is useful in large quantities is the merest assumption. As to the notion of its assisting the process of blood oxidation, the probability is all the other way, for its energy would be much more likely to cause it to oxidize, and destroy the lung itself, than to permit it to pass quietly into the blood, and effect the work performed by the more gentle oxygen. The simple fact is, that we know next to nothing about this branch of the subject; and if, instead of guessing at random, we were to set to work to try to elucidate some of the obscurities by which it is surrounded, or, at any rate, were to wait until others had done it for us, we should act a much more sensible and modest part.

For the future there is every hope. The main elements of the inquiry have already been acquired, and a strong body of experimenters are at work upon it. The British Association has appointed a committee to investigate some of the moot points, and from the high eminence of every member of it, we may justly anticipate some important contributions to our knowledge.

Tanning---A New Process.

A process has been invented in England for preparing hides to receive more readily the action of tannin. After the hair and particles of flesh have been removed, and the hides have been properly cleaned by the action of lime, the first step in this new process is to place the hides in water sufficient to cover them. The hides are to be placed in separately, with the fleshy side upwards, and are to be sprinkled with bran in the following proportions:

Light hides, for uppers, etc., each skin....	6 ounces
Calf skins	3 "
Sheep skins	4½ "
Heavy hides, for sole leather	14 "

In this vat the skins must remain until fermentation has taken place, which will be, in warm weather, in about two days, but in cold weather somewhat longer. After this the skins must be removed and scraped from any adhering particles of lime or other substances. When this has been done the skins are subjected to the action of mustard seed, which forms the distinguishing characteristic in this process. It is carried out in the following manner: A vat of proportionate size is filled with a sufficiency of water to cover the skins, and to this water there must be added for every hundred pounds weight of the skins, when dry, five pounds of ground Italian mustard seed, and five pounds of barley meal. When these ingredients have been thoroughly mixed with the water, the skins must be dipped therein, so that they may be perfectly saturated with it, and they must be left in this dip for the following length of time:

Calf, sheep, or goat skins	24 hours
Light hides and kips	36 "
Heavy hides, for sole leather	48 "

When this time has expired the skins must be taken out and hung up to dry, but only partially, as when subjected to the next process they should still be in a damp condition. The dip which has just been described has a very powerful action on the skins; the combined action of the mustard seed, barley meal, and heat thereby generated, is to open the pores of the skins, and thus to render the remaining processes in tanning them by means of bark much more speedy than under any other methods hitherto known.

A New Alloy.—A new alloy, forming, we are told, a beautiful white metal, very hard, and capable of taking a brilliant polish, is obtained by melting together about 70 parts of copper, 20 of nickel, 5½ of zinc, and 4½ of cadmium. It is therefore, a kind of German silver, in which part of the zinc is replaced by cadmium. This alloy has been recently made in Paris for the manufacture of spoons and forks which resemble articles of silver.

The British Government and Inventors.

The relations subsisting between inventors and various branches of the government, needing and using the intelligence of inventors, have long constituted a topic of painful comment and incrimination. British law regards every inventor as an outlaw; as a man having no legal rights in any matter relative to the use of his invention by the government. It would be an insult to the reader's intelligence were we to debate the moral right and wrong of this decree. We only state what is the law, expressing, at the same time, our conviction that public opinion would never second or sanction the strict upholding of this, in any case of undisputed use and adoption by a governmental department of an invention originating with a member of the public. Not wishing to overrate the grievances inventors have complained of in the course of their dealings with the government, we are free to admit, that although the legal ruling is precisely as we have stated, yet the cases of inventors whose inventions have been adopted by the government, remaining totally unrewarded, are comparatively few. Usually some bonus has been conceded, but the manner of this assessment and award has been hitherto most unsatisfactory. Government, in these matters, has acted as though prompted by the desire to give an inventor the very maximum of trouble; to tire him out by all sorts of unnecessary delay, whereby in time his hopes and aspirations might be lowered to a convenient despair for inducing him to accept a trifle. Indications, we are gratified to state, are not wanting that Mr. Gladstone's administration is not insensible to the past injustice to which we have referred, and is resolved that inventors coming before governmental departments, and having their inventions ultimately adopted, shall be equitably treated in future. The first indication is seen in the terms of a recent announcement issued from the War Office, for the consideration of inventors, whereby various checks are imposed to the suppression of a valuable invention; first, establishing a more fairly constituted tribunal than heretofore for the assessment of value; secondly, defining the mode of payment, and indicating the precise time. In former days, if a man possessed an invention bearing upon warlike art, and wished to treat on behalf of the same with the government, his usual course of proceeding was the following: He made application either to the War Office, the Ordnance Select Committee, or the Admiralty. His letter of communication met a prompt response, accompanied with a printed statement of the terms on which alone the government would condescend to treat with him. He must defray all expenses; he must disclose all particulars; finally, he must trust wholly and absolutely to government for reward in the event of ultimate adoption. Now, the common opinion is (and it is one that, conscientiously, having arrived at belief through evidence within our own knowledge, we cannot gainsay) that, on many occasions, inventive particulars thus communicated to the War and Admiralty departments, have been turned to unfair account; that, by some means or other, those particulars have become known to members of the public service, "improved," ostensibly, at least, into discoveries of their own, to their sole advantage. If this did not happen, it readily might have happened. So powerful an incentive to profitably unfair dealing, without much chance of discovery, should never have been permitted. By the terms and wording of the recently issued memorandum, we are glad to see a check imposed on this contingency of unfair dealing. Inventors now are given to understand that their communications are not to be addressed to either of the war departments, but to one of the Under-secretaries of State, who takes upon himself the responsibility of laying them before the War Department, where due consideration is pledged. The government do not hold themselves responsible for any expenses an inventor may have occurred in the inceptive stages of an invention, but express readiness, under certain circumstances, to contribute towards expenses necessary to the development of an invention. The next point of importance in the recent memorandum is relative to the tribunal of assessment, which is to be a committee held in the War Office, a great improvement on the old mode of leaving this matter to the discretion of the legal heads of departments. Whether or not any civilian element is contemplated in these War Office committees of adjudication, the memorandum does not state; but if not, the machinery will be needlessly defective. Lastly, as regards time and mode of payment in behalf of inventions deemed worthy of acceptance and adopted, these matters—so important to inventors—are, by the memorandum, clearly defined. As soon as the value of an accepted invention has been assessed, the sum—under sanction of the Secretary of State—is to be inserted in the estimates, when, on being passed by the House (but not till then), the inventor will receive his award. The new *regime* may be said to have found its first application in the award to Captain Moncrieff; for, although government had come to a conclusion in respect to this matter, before the memorandum to which we have been referring was issued, yet the spirit of it is clearly seen in the terms and manner of Captain Moncrieff's award. Altogether, the aggregate sum receivable from the government by this gentleman, may be set down as some twenty thousand pounds. After paying him for the expenses of drawings, models, etc.,—a concession rather in advance, by the way, of the terms of the new convention—he is to have ten thousand pounds on the passing of estimates, and five thousand more at the date when his assistance may be no longer required by government in further developing his system. He is to be paid a thousand a year for such time as he has been already assisting the government, and for all future time until his services are no longer required. Then he is to receive five thousand pounds Altogether this is an arrangement more liberal—as we have already said—than the new memorandum, strictly interpreted, would warrant inventors to expect. All the better, is what we say; and if this liberality of treatment is to be repeated, all the better still. The English public, we are right sure, will never uphold unfairness by the government to inventors who have advanced the interests or increased the power of any public department.—*The Engineer.*

Agricultural Implements.

Probably no department of invention has on the whole more munificently rewarded the genius expended upon it, or still offers greater inducements to inventors than that of agricultural implements. It is true that powerful and effective reapers, and threshers, and a host of minor inventions have been brought nearly to perfection, so far as anything human can be said to be perfect; but there remain very many agricultural operations to the aid of which machinery has not been yet successfully applied.

The annual address before the New York State Agricultural Society, delivered February 10th, by Thomas H. Faile, the retiring president, contained among much other interesting matter some statements of special interest to inventors.

He spoke in the highest terms of the beneficial effect upon both visitors and exhibitors of implements at the annual fairs of the society, bringing together as they do the manufacturers and those for whose benefit improved machinery is designed. He says "I think it a mistake to suppose that manufactures of agricultural implements attach any importance to the *cash value* of premiums. It is the opportunity to exhibit and make them known which they want, and this they get at every well conducted fair, whether State or county: in proof of which, I was told by an exhibitor of a small implement at the last fair, that he had spent over $30,000 in exhibiting and introducing it, and had been well compensated for his outlay by sales which he never could have made but for the fairs. The exhibition of machinery and agricultural implements was the crowning excellence of the best fair. The increased number of new machines, and the improvement of those long known for their usefulness, showed in a stronger light than ever before, the marvelous inventive genius of our people. The time has passed when mere hand work can make the cultivation of the soil remunerative, and it is only by the use of improved implements that success can be attained. Even in the remote parts of our country the scythe, the sickle, and the cradle, have been superseded by the mowing machine and the reaper, and by means of these and other agricultural implements, the fertile lands of the West have been brought into use, making Chicago the most important port in the world for the shipments of cereals.

"The different trials of implements—mainly agricultural—have resulted in such vast benefit, not only to farmers, but to the whole community, that another should not be long deferred. In ditching and digging machines especially, there is open a wide and very important field for improvement and invention; and when the vast quantities of wet lands, which could be reclaimed and made valuable by ditching, and the unavoidably slow work of the present method is considered, it seems to me that the society might do great good by offering an oportunity for a competitive trial of these important machines; more especially as it is now claimed that there is a rotary digging machine in Illinois which has been successfully operated

"It has been suggested that a separate trial should be made of portable steam engines, sewing machines, etc., but it would seem that all such inventions can be more effectually tested by those whose interest it is to procure the kind best adapted to their purposes. I allude to manufacturers, especially those using sewing machines, who in preparing the various articles in their line, aim to have the best, and to whom $5,000, $10,000 or $20,000, is a small expenditure for ascertaining that fact. Hence I think that no premiums or certificates of merit should be given to such articles at our fairs. Nor do I think there should be any awards for pianos or musical instruments of any kind. In the great national exhibitions held in London and Paris, where the highest musical talent in the world was congregated, it was no doubt proper; but farmers are not supposed to be Mozarts and Rubinis, and a certificate of merit or superiority of one instrument over another is simply absurd, and leads to unnecessary trouble and dissatisfaction. As before mentioned, the opportunity to exhibit to such large assemblages as frequent our State fairs, is what the makers want, they knowing full well the advantages to be derived from it."

It will be seen here that the privilege of exhibition is regarded as a sufficient inducement to manufacturers of other than agricultural goods, at the annual fairs of the society, as a premium even when obtained would be of little service to makers of pianos and other articles not strictly pertaining to agriculture. While acknowledging the force of this view as regards piano manufacturers, we think the exclusion of sewing machines unwise. A premium on a sewing machine at a State agricultural fair is well worth competing for, especially as sewing machines are almost as common now in farmers' houses, as churns.

There can be no doubt that the annual fairs of this society have been a great stimulus to the demand for improved agricultural machines and implements, and have aided inventors in bringing their improvements before the public. If continued in the same spirit of liberality that has hitherto characterized their management, they will be still sustained by all classes of manufacturers and inventors; but a narrower policy may prove disastrous, unless careful discrimination is used in the exclusion of articles from the prize list.

Furnaces for Smelting Glass.

An improvement in the method of creating drafts in glass furnaces has been made by James Davison, of England. At present long caves are placed under glass furnaces, and large cones of brickwork above them, in order to get the sufficient amount of heat requisite for the perfect fusion of the materials used in glass making. Mr. Davison's invention does away with these expensive and inconvenient draft creators. He employs steam, which is generated in any suitable boiler, and which is injected into small flues, chimneys, or funnels, by steam pipes or jets; these he places in any convenient part of the furnace, and one or any number may be applied according to the size of the furnace, and the number of glass pots it may contain. In each flue or chimney the steam pipes or jets may be either fixed or portable; they are provided with stop cocks so as to regulate the supply of steam, and in this manner a draft is created and the heat of the furnace increased and regulated at pleasure. The principal features of this invention are, the application of steam injected into furnaces for the manufacture of glass, and the materials employed in that manufacture for the purpose of obtaining the necessary draft; but the flues may also be so arranged as to consume the smoke from the fuel.

TRANSPORTATION OF FRESH MEATS TO MARKET.

On page 323, Vol. XV., of the SCIENTIFIC AMERICAN, in a leading editorial, we discussed the above subject, offering some suggestions as to modes by which meats could be preserved fresh during transportation over long distances. We closed the article referred to with the following paragraph:

In the more immediate Western States, it is possible to construct cars so that animals may be slaughtered there, and the fresh beef delivered in a wholesome condition in this city. In the Southwest this plan seems at present impossible, and the only mode by which this object can be attained will be by boats constructed for the express purpose of carrying the slaughtered animals from the ports of New Orleans or Galveston direct to the Atlantic seaboard. This project seems to be a very difficult one, we admit, but science, well directed by capital, may yet accomplish the result.

Our suggestions were made with reference to the construction of refrigerating cars and boats for the purpose specified, and we now have the satisfaction to record that they have borne good fruit.

The New York *Herald*, of March 19th, says:

Yesterday a new invention, in the shape of machinery for making ice and performing the refrigerating process, was tested on board the ship *William Taber*, lying at the foot of Nineteenth street, East River, in the presence of a number of scientific and mechanical gentlemen, to whom invitations had been extended. The ship already named has been thoroughly fitted with this new apparatus for the preservation, during transportation, of fresh beef and other perishable food for a long period, and she will sail for Texas some day next week, to return with a large cargo. The properties and designs of this novel invention may be briefly stated as follows: The inventor has contrived a series of pumps, by means of which he obtains a pressure on the carbonic acid gas generated in the process of working, which was before obtained by the action of oil of vitriol on carbonate of lime. When these two properties are brought together they must, under this process, decompose. He has reduced the carbonic acid precisely in this way, and allows it to escape into bags. By the application of the pumps, which are surrounded with water, he reduces it to a liquid state. The first pump, under this pressure, carries 75 pounds to the square inch, the second 300, and the third is capable of 1,200 pounds to the inch, which pressure is amply sufficient to liquefy carbonic acid gas. Having reduced it to a liquid form, it necessarily becomes deprived of all its caloric, and the moment it becomes liberated it again assumes its gaseous form and takes caloric from all surrounding points. The inventor's first idea was to utilize carbonic acid gas for the production of ice. One of the principal features in the apparatus is an iron case lined with copper, and through which are copper tubes set in the top and running clear through. This case is surrounded with wood and well packed by other material to prevent it from receiving caloric from the outside. The tubes are filled with water, which soon becomes converted into ice. Another novel feature in this invention is that after the gas has performed its office of converting the water into ice once it is allowed to escape into gas again. It is now ready to be reliquefied and to go over and convert another quantity of water into ice. The expense is limited to the interest upon the apparatus used, the cost of a given quantity of carbonic acid gas, and the cost of running a steam engine and apparatus to liquefy it and turn it into a gaseous form again. Fifty dollars' worth of carbonic acid gas, it is claimed, would make numbers of tuns of ice. The two great principles, then, in the mechanism of the affair, seem to be, first, the application of pumps to the liquefaction of carbonic acid gas; and second, the remaking of it into gas over and over again *ad infinitum*. On experimenting the inventor also found that the passage of a current of air through the tubes produced an intense degree of cold, and the idea at once occurred to him that he could, by means of a "blower," make a current of air available to cool a room of any given size, and in this he succeeded, as exemplified yesterday. The same current of air goes through the "blower" repeatedly. In a temperature of forty-five degrees, in a room sixty-six feet long, thirty-three wide, and thirteen high, in eight minutes the thermometer went below zero twenty-six degrees. With the aid of this machinery the ship *William Taber* is prepared now to carry from Texas to the New York market, it is claimed, 400 tuns of fresh beef. Through the agency of this process, it is also stated that all kinds of fresh meats, fresh fish, fruit and vegetables can be preserved for an indefinite time in a cold, dry atmosphere. The value of 400 tuns of beef in the New York market is about $96,000; the expenses of the trip to Texas is estimated at $10,000, which would leave the handsome profit to the inventors, whoever they may be, of $86,000. After the apparatus had been thoroughly tested, as above described, the gentlemen present partook of a handsome *dejeuner* on board the ship, during the progress of which the inventor performed some very interesting scientific feats, such as boiling an egg hard, making champagne cream, solidifying quicksilver and other things pertaining to the laboratory of the chemist, through the agency of carbonic acid gas and his refrigerating process.

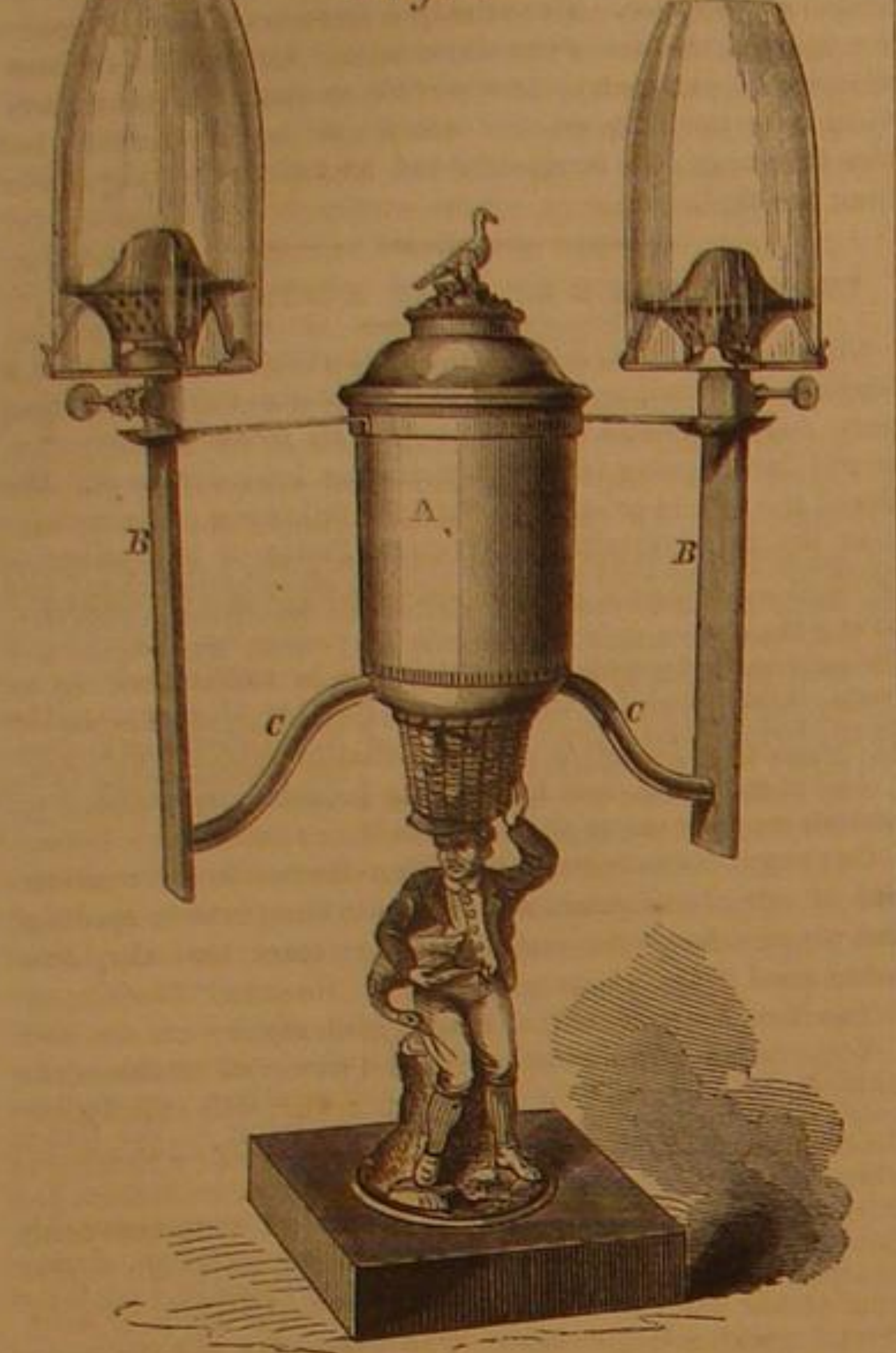
THE third pumping engine for the Brooklyn Water Works, now being built, will be the largest and most powerful pumping engine in the world, with the exception of one in Cincinnati.

LUMBERING operations in Canada are nearly stopped by the extraordinary fall of snow during the past winter.

SANFORD'S KEROSENE SAFETY LAMP, AND SAFETY ATTACHMENT FOR COMMON LAMPS.

Accidents from the use of illuminating kerosene oil ought not always to be attributed to the impurity of the oil, or to the presence of the volatile explosive fluids that form a part of the composition of crude petroleum. There can be no doubt these frequently exist in oil that is sold as perfectly safe, and accounts of explosions of lamps are not infrequent. The law in relation to the purity of kerosene would, if rigidly enforced, prevent these disasters, but it is doubtful if an enforcement of

Fig. 1

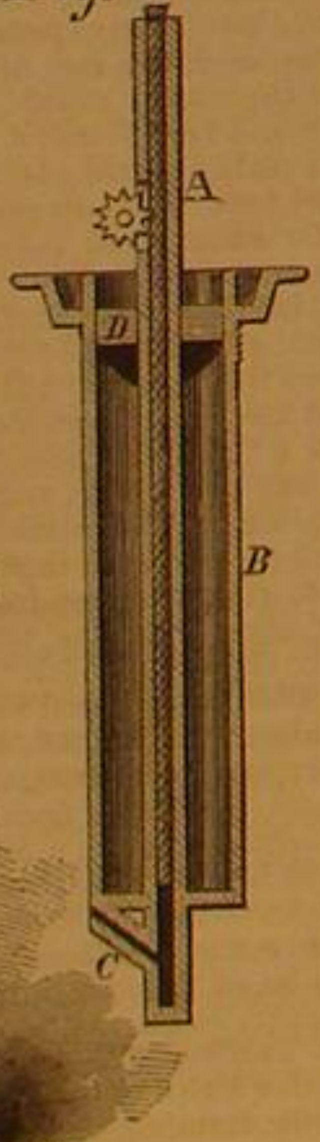


the law is possible in all cases. But many kerosene accidents do not result from explosion, but from overturning or breaking the vessel, or lamp, and the ignition of the fluid, which is in all cases highly inflammable. A portion of this danger could, however, be removed by the employment of a perfectly safe lamp.

Dr. Sanford, of Keokuk, Iowa, is satisfied that he has produced such a lamp, a representation of which is seen in Fig. 1, accompanying this article. His principle is to remove the flame to a safe distance from the oil reservoir, to make the latter of metal, and to feed the oil to the wick only in small quantities, as required. The lamp is simple—does not require an engineer to run it—easily kept in order, and gives a good light.

Fig. 2

Fig. 3



The reservoir, A, is of polished metal, so as not to absorb the heat rapidly, and is closed by a screw cap. The wick tubes, B, are about three inches from the lamp, supported by braces, as seen; on the lower ones of which rest the pipes, C, which convey the oil to the wicks. The burners are of the usual form. The distance between the flame and the reservoir effectually prevents any heating of the oil by conduction, and if the lamp should fall and break the pipes, the amount of escaping oil would be too little to produce any disastrous consequences.

Fig. 2 is Dr. Sanford's plan for rendering the ordinary lamp safer. It is a hoop considerably larger than the lamp, to which is attached a series of buffers on its inside, made of rubber or other elastic substance, to protect the lamp from concussion. This guard is held in place by the cap of the lamp being screwed down upon it. The guard may be made as ornamental as desired.

Fig. 3 is a vertical section of the wick tube and its accompaniments. The tube proper, A, is flat, as are the tubes, B, in Fig. 1. It is inclosed in a cylindrical tube, B, and projects through it at each end. Both are closed at the bottom except the small passage, C, leading from the wick tube to the oil in the lamp. The top of the round tube, B, is the screw cap of the lamp. Between the wick tube and its outer cylindrical sheath, is interposed, near the top, a gland, D, of some material not a conductor of heat, and the rest of the space between the tubes contains a fluid, which, if the lamp is overturned, flows out and extinguishes the flame if the oil should ignite.

These inventions are both covered by letters patent. For further information address J. F. Sanford, at Keokuk, Iowa.

Improved Adjustable-Reach Velocipede.

Undoubtedly the fewer the mechanical appliances interposed between the power and the proposed result—the force exerted and the force delivered—the more satisfactory will be product of the two elements. This theory is specially applicable to the velocipede. Four-wheeled vehicles propelled by the physical power of the rider are old; the three-wheeled carriage is more modern; the two-wheeled vehicle, now so popular, may perhaps be compelled to make way for the one-wheeled contrivance; and surely this latter is bringing the theory of wheel-riding to its ultimate—perhaps carrying it beyond its proper limit.

The machine shown in the accompanying engraving is, in effect, a unicycle, the small following wheel being only one point of suspension for the reach, and acting only as a truck or friction wheel. The driving wheel, which is also the steering wheel, may be of very great diameter, as it is worked, not by direct connection of the feet with the treadles, but by the hands and feet both, through the medium of connecting rods between the cranks and a walking beam. The reach supporting the seat is hinged to the lower end of an upright pivot secured in a yoke at the top of the forked brace, the lower end of which are boxes for the reception of the ends of the driving-wheel

SOULE'S SIMULTANEOUS-MOVEMENT VELOCIPEDE.

axle. This arrangement allows the wheel to be guided to the right or left, and also to be projected under the seat of the rider, or further in front. By this arrangement, when great speed is desired and the state of the road will permit, the rider may bring the wheel directly under him, and in descending grades he can project it in front to guard against the danger of being thrown over. In order to secure the wheel in either of these, or any intermediate position, a sector, notched on its upper side, and forming a portion of the reach, passes through a slot in the yoke, and a spring catch fits into the notches to hold the wheel and reach in the relation desired.

The inventor claims as advantages over the ordinary two-wheeled vehicle, that it is easier balanced, when in motion, can be propelled at a higher rate rate of speed with the same amount of exertion, and can be driven over any ordinary road passable for other vehicles.

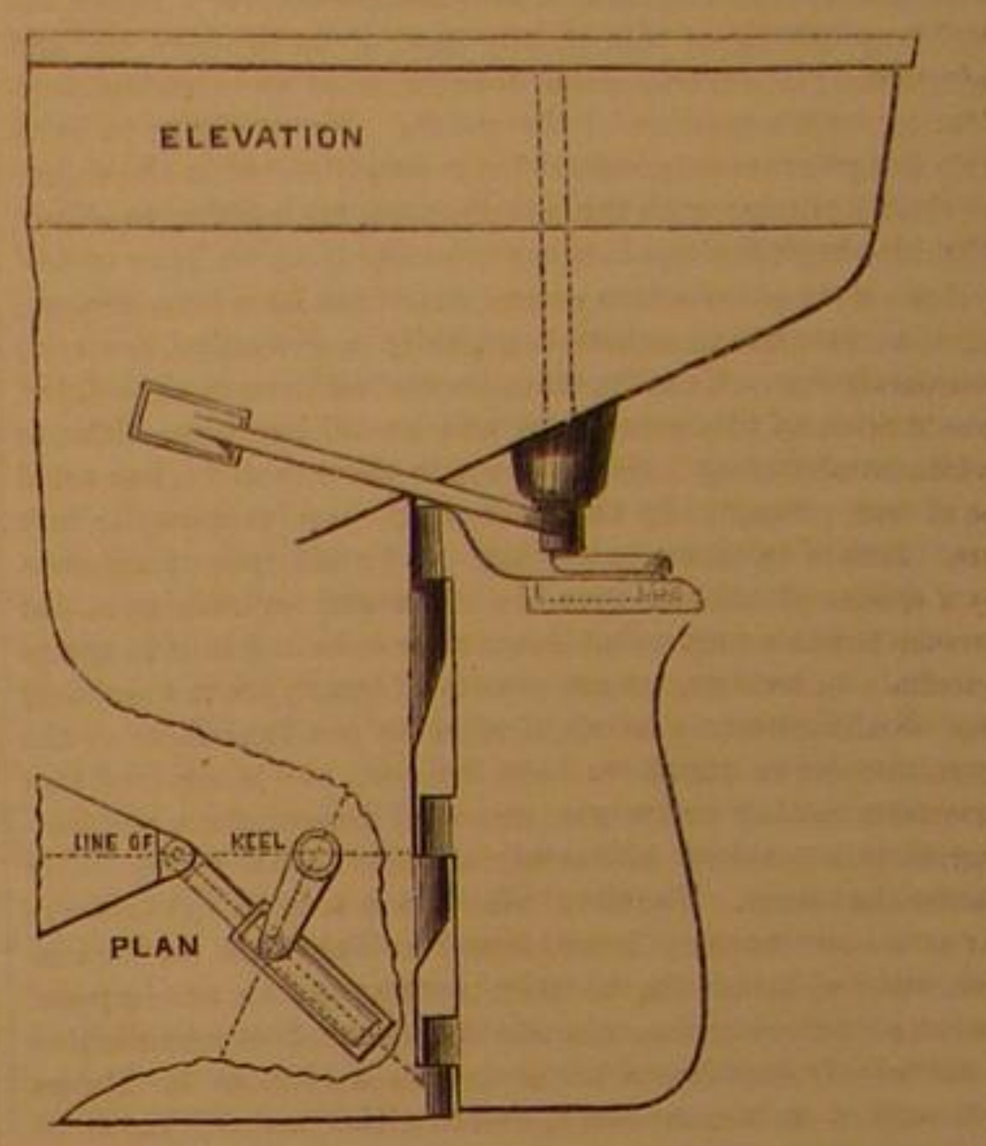
Patent now pending through the Scientific American Patent Agency. Further information may be obtained by addressing the inventor, L. H. Soule, Mt. Morris, N. Y.

Prof. Alonzo Jackman, of the Norwich University, Vermont, claims that he originated the idea of an ocean telegraph. In proof of this he republishes an article from his pen, published in the Vermont *Mercury* in 1846.

New Method of Working Ships' Rudders.

A correspondent of the London *Engineer* furnishes that journal with the following, which we transfer to our columns:

"I beg herewith to bring to your notice a new kind of rudder for seagoing vessels, or rather a new method for working the rudder. With the common rudder the greater the angle of divergence from the line of the keel the more power is required to bring the rudder into that position. With large vessels this power is something enormous, and we have lately seen in the letters from Mr. Reed that the rudder of the



Minotaur requires the united exertions of seventy-eight men to put it hard over when at full speed. To avoid this the balanced rudder has been used, and with evident advantage as regards the reduction of power required to work it. But the balanced rudder and its post have to stand considerably more strain and stress than the common rudder, inasmuch as the full force of the waves is exerted against a nearly unyielding surface held in position by the upper bearing and the lower footstep. This latter is generally carried either by a projecting spur or on a framing securely fitted to the stern, and naturally throws great strain on the latter, is liable to being damaged, and awkward to get at. In fact the lower footstep has always been the stumbling-block against the application of the balanced rudder, which otherwise would, no doubt, long since have been more generally adopted. My improved rudder, as shown in the accompanying tracing, is designed to combine the advantages of both the common and the balanced rudder without their attending drawbacks.

"The rudder is suspended from the stern-post in any of the ways usual with the common rudder, but it has no rudder-post or spindle. A little behind the hinge, at a distance varying with the size of the rudder, an upright shaft or spindle is fixed, reaching to within a little of the rudder-blade, and carrying at its lower end a strong crank arm or lever with a pin provided at its outer extremity. The upright spindle is supported by a strong bearing near the crank, the upper end being connected to suitable steering gear. At the upper edge of the rudder a groove is provided, in which the crank pin can be made to slide. As the spindle is turned to the right or left, the rudder follows the movement of the crank to a less degree, diminishing in amount as the angle of divergence increases, until, when the rudder is hard over, the crank in plan stands nearly at right angles to the direction of the rudder.

By this arrangement the leverage of the strain transmitted through the crank arm from the rudder to the steering gear is reduced as the angle of the rudder with the line of keel increases, and the dimensions may be chosen in such a manner as to cause very little variation in the strain on the gearing during manipulation. In my sketch the rudder is shown making an angle of 45 deg. with the keel, and in practice the crank will be placed so as to allow the rudder to swing back into its original position when released. This way of working the rudder has also the eminent advantage of being easily fitted to existing vessels, in which case the rudder-post may be retained as a provision against accident. I need hardly add that the arrangement shown in my sketch represents only one out of a great many varieties in detail which may be adopted to suit circumstances. If you consider the foregoing sufficiently novel to merit your attention, I shall be obliged by insertion in your next issue, for which please accept my thanks in advance."

JOSEPH BERNAYS.

London.

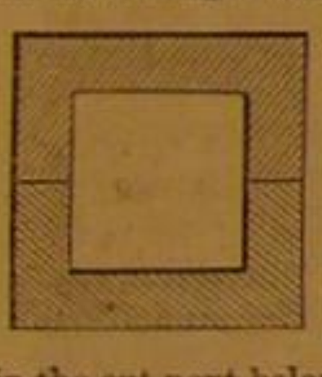
M. Friedel has just discovered that siliciureted hydrogen gas is entirely decomposed by the electric spark, giving rise in the eudiometer to a shower of a brown amphorous silicium.

CAST-WELDING OF STEEL AND IRON---A NEW COMBINATION RAIL.

Not a few important improvements in the art of construction have been effected by using old principles in a new way; and it does not appear that those who thus divert the ideas of others into novel channels, deserve less credit than more original inventors. Success is, after all, the popular test of inventive skill; and as an invention fails or succeeds, so will the voice of public opinion award praise and wealth on the one hand, or oblivion on the other, to the producer. A short time since an apparently novel, and certainly ingenious application of an old principle to a new purpose was brought under our notice in Sheffield. Whether the idea involved is or is not absolutely new, we shall not pretend to decide. Certain it is, that if as successful as it promises to be, the invention will effect a considerable advance in the manufacture of rails, and therefore we have no hesitation in bringing it prominently before our readers.

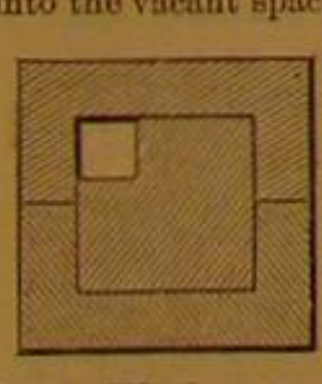
For very many years attempts have been made, from time to time, to produce a rail which shall have a hard table and a comparatively soft and ductile web and foot; such a condition would obviously best be complied with by a rail, the table of which would be of hard steel, while the web and foot would be of iron. Nearly all these attempts have resulted in failure. Dodd's rails, the upper tables of which were converted by a species of cementing or case-hardening process, have not become popular; either because the process of converting was uncertain in its results, or the cost was greater than the result was worth. Steel-topped rails, made by welding the steel top to an iron bottom failed, because, under heavy work, the steel invariably peeled away from the iron, unless the weld were carried into the web; and even then only puddled steel, little harder than some varieties of iron, could be used. No one, so far as we are aware, has attempted to weld cast steel to an iron web by hammering or rolling. The cost, including wasters, would be enormous, and the difficulty of securing a perfectly sound weld over miles of bars insuperable. It follows that rails, as now made and generally used, are all iron or all steel, or of the compound type used by Mr. Ashcroft on the Charing Cross line, in which a steel top and web are secured between wrought iron angle flitches by cross bolts. We have recently examined rails with cast steel tops made at Sheffield by, as we have said, a new application of an old process, which bid fair to solve a difficult problem. Too few of these rails have been made to enable us to pronounce the process a complete success; but bearing in mind the very imperfect nature of the experimental appliances by which they were produced, the results have been very satisfactory; and as new furnaces and plant are being put down to test the principle thoroughly, we shall soon be in a position to pronounce a positive verdict on the subject, one way or the other.

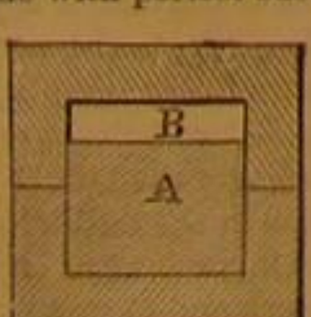
The process of manufacture is excessively simple and may be explained in a very few words. An immense number of cutting blades, for shearing iron, slicing tobacco, carpenters' planes and chisels, wood-turning tools, etc., are made every year in Sheffield, in which a very moderate quantity of cast steel, of the best quality, is secured to anything rather than a moderate quantity of, it may be indifferent, iron. Popularly, it is thought that the steel is united to the iron by welding under the hammer; but this is contrary to fact. The cost would be too great, and the weld might or might not be good. A far more elegant system is adopted. Let us suppose that a heavy steeling for a pair of shears is required. In producing this, an ordinary steel ingot mold is taken, and set up on end in the casting house. The mold is made of iron, rectangular in section, and in halves, secured together by bands and keys. For convenience, we give here a plan of the mold, looking down it from the top.



A pile of scrap iron is heated and forged under the hammer. Its weight may be anything, from 30 lb. or 40 lb. to 2 cwt. or 3 cwt., and in section its shape is shown in the cut next below.

This pile or bloom is about the same length as the mold. A short time before the steel pots are ready to be drawn, the pile is heated, in a proper furnace, to a bright red heat. It is then brought quickly to the casting house and placed in the mold. The whole, then, is in cross section, as in the third cut. Melted cast steel, in proper quantity, is then poured into the vacant space, and the result is that the steel unites so soundly to the iron, the surface of which it partially fuses, that it is difficult to tell, on making a cross section, where the iron begins and the steel leaves off, to the one sixteenth of an inch. The ingot may then be reheated and worked into any required form by rolling or hammering, the steel always reducing in a given ratio with the iron. We have seen combination ingots, consisting of some 4 cwt. of iron and 1 cwt. of steel, thus made with perfect success. This is the principle which has been applied by Mr. E. Gray, of the Moscow Works, Sheffield, to the manufacture of steel-topped rails. He places within an ingot mold, of the required size, a heated pile of iron, A, and he fills up the vacant space, B, with fluid cast steel. From personal inspection of numerous samples, we have ascertained that the union of the two metals is perfect. No subsequent rolling or hammering will separate them.





In converting this ingot into a rail, it is passed through rolls in the usual way, but care must be taken to drive the mill as though it were working altogether on steel. If the pile is highly heated, and the rolls are run quickly, the steel will behave precisely as cast steel always behaves under such conditions; it cracks and splits, and breaks up along the edge of the table. If the pile is moderately heated, and the rolls run slowly, and with an easy draft, the steel works perfectly, and a rail results, which, judging from inspection, leaves nothing to be desired. We need hardly add that, should the process be as successful as the inventor—in our opinion reasonably—believes, a rail will shortly be introduced to the public which will be superior to any other now in the market, possessing, as it will, that combination of hardness and toughness most desirable and most difficult of attainment. The process, it will be seen, was applied to other purposes than the manufacture of rails nearly thirty years back. It is, of course, possible that difficulties may arise, which even the practical steel worker—and Mr. Gray has been working steel all his life—cannot foresee, which will defeat the success of his process. But it is not easy to understand in what they will consist, and we are, upon the whole, justified, we think, in regarding Mr. Gray's invention as one full of promise, and likely to lead to very important results.—*The Engineer*.

PROGRESS OF THE VELOCIPEDE.

We are in receipt of several communications relative to the construction of roadways for velocipedes. Among the most feasible of these is one from an Albany correspondent, who recommends a way consisting of a single plank in width, laid so as to be nearly or quite level with the ground, one on either side of the street, so as to permit of travel both ways. The plank need not be more than an inch and one-half in thickness, cleated in the back to prevent warping and springing.

Another suggests rails, the wheels of velocipedes to be flanged, a plan, which, with some modifications, has been proposed in England. Indeed, an application for a patent on a velocipede railway, has been made to the Lord Chancellor of England, of which the following is a description: One single line of rail is arranged in the middle of the roadway. The rolling stock is constructed with four bearing wheels, with double flanges, all in one line in the middle under each carriage, instead of having bearing wheels placed on each side. Traversing screws and gear are employed for shifting the wheels laterally, relatively to the body of the carriage, until the load is perfectly balanced on the wheels. The perpendicular position is still further preserved by the addition of one or more wheels on each side of the carriage, so arranged by working in slots, as to run freely upon the road without bearing any part of the weight of the carriage, except when the carriage inclines to one side or the other.

Another correspondent suggests the Croton aqueduct, from the Westchester side of Harlem river to Central park, in New York city, as a grand "boulevard" or highway for velocipedes; the top of the aqueduct to be covered with Nicolson pavement, having a strong and ornamental rail on each side, with a low central rail to divide the up and down travel.

We regret that, delightful as would be such a velocipedal Utopia, the expense connected with the scheme compels us to pronounce it impracticable.

We give herewith an engraving of a water velocipede, devised by a Boston inventor, which is a very neat device. It needs no detailed description, as its operation will be readily comprehended from the engraving. The rudder is worked

by two cords passing from the steering bar, over pulleys fixed upon the side of the boat below and in front of the operator, and from thence back to the tiller.

The Hamilton county *Evening Times* has an account of a velocipede which it says "may be classed in the genus *Velocipedus giganticus*, is fashioned with three wheels, two large ones, of over six feet in diameter, and one small wheel forward, working on a pivot, by which the establishment will be guided. The locomotive power is communicated to the axle of the large wheels, by means of four treadles, two persons being required to drive the machine at full force, who are comfortably seated in an ordinary carriage-seat over the axle. A third passenger may be accommodated on a forward seat, and manage the steering apparatus, or either such assistance may be dispensed with. An ingenious arrangement is attached to the axle, by which the treadle power can be thrown off when descending declining ground, and the establishment be allowed to run by its own momentum.

It thinks that gigantic velocipedes may be immediately constructed on this principle, with wheels from twenty-five to thirty feet in diameter, to supersede those old-fashioned abominations, the ordinary stage coaches, and to be propelled by the passengers themselves.

The number of velocipede halls in New York and Brooklyn is now about thirty, and "still they come." Most of them are schools of instruction, where, for a moderate fee, the most awkward individual in existence, can be taught the management of the erratic, but not untamable, iron steed.

An important fact was elicited at a recent display of velocipede riding on Clinton street, Brooklyn, and that is, that the large wheeled velocipedes ride easier and go faster than the small wheeled machines, even when the latter are ridden by the best riders. Another important fact, developed by the experiment, is, that an effective brake on the hind wheel is positively necessary. We have not yet seen a brake which had enough iron to cover the tire of the wheel with. All those now in use scarcely have an inch of iron surface to bear on the wheel, when four times the amount would not be too much. The leather thongs, too, connecting the brakes with the guiding arms, should be replaced by the wire cord, as it is absolutely necessary that the brake cord should be made of material that will not give way.

A slight grade affects the progress of the small-wheeled velocipedes considerably, an effort being required to propel a machine from Atlantic street to Montague, while, on the other hand, a man can start from Montague street to Atlantic, and go all the way without using the treadles or putting his feet to the ground. The rule is, that the larger the wheel the easier a grade is ascended. It was decided by a unanimous vote that good spring seats were requisite on the Nicolson pavement.

A noteworthy feature of the display was the fact that not a solitary horse shied at the velocipedes, much to the disgust of the old fogies, who had prophesied that bicycles would lead to endless accidents from frightening horses in the street.

As some physician of this city has been publishing a sensation statement about certain injurious effects likely to occur from the use of the velocipede, the following from a leading practitioner may serve to counteract any fears that may have been created in the minds of the timid. He says: "I look upon this mode of exercise with this physiologically constructed machine, as one of the most brilliant discoveries of the nineteenth century; the grand desideratum that will emancipate our youth from muscular lethargy and atrophy that are so common."

The *Ironmonger*, an able London periodical, thus speaks of the utility of the velocipede: "Recognizing, as we do, in the velocipede a positive addition to the locomotive powers of man, we feel justified in again recurring to the subject, more particularly with the view of placing our readers *en courant* with what is being done to meet present requirements. Since our last issue new evidences have been presented, that, although England has been slow to follow the movement in France and the United States, a general demand is springing up, so much so, indeed, that our velocipede manufacturers experience already the greatest difficulty in supplying orders. We hear of Sheffield and Birmingham houses being engaged to fulfill the orders of London manufacturers, while velocipedes are being daily imported from France. Already West-end and City clubs are forming; and if there is no intention, as in France, of seating professors of the noble art of 'velocipeding' in the chairs of colleges, there is every prospect that large training schools will shortly be opened. Nor is this remarkable; the velocipede is already recommended by convenience, utility, and economy."

To this may be appropriately added the statement of the *Velocipedist*, for March: "The shipment of velocipedes from this country to England has commenced; the Inman steamer of Saturday last took a 'Pickering' machine, which is to be followed by others as soon as completed."

We have received the following communication:

MESSRS. EDITORS:—There is to be erected here a large rink, and the committee desire to be informed where rubber tire can be procured and put on to velocipedes. If you will be kind enough to refer us to some one who can do it, you will very greatly oblige a subscriber to, and an admirer of the SCIENTIFIC AMERICAN. GEO. A. COLES.
Middletown, Conn.

Having referred this communication to a prominent rubber manufacturer, we were informed that he knew of no place where these tires could be obtained. Every velocipede manufacturer in the country is trying to get this done, but none of them have as yet succeeded. It is a difficult job to do.

A Silk Community in California.

The latest and most novel idea in the silk culture is Mr. D. F. Hall's embryo "silk community." According to the Los Angeles *Star*, Mr. Hall has bought a large tract of land, forming part of the San Jose Ranch, about thirty-two miles east of Los Angeles. He proposes to lay off the entire tract, which is two miles and a quarter one way, by one and a quarter the other, into blocks and streets of suitable dimensions, for the convenience of the residents, and offer it for sale to actual settlers. The blocks will be forty acres in size, to be subdivided into lots of from one to ten in size. Ten-acre lots will only be sold to those who will make improvements thereon.

"There are certain benefits to be derived from a settlement of this kind, entering upon and making a specialty of the silk culture, that will particularly commend themselves to those wishing to enter the business, and particularly immigrants from the densely populated countries of Europe. For an extensive cocoonery, but a comparatively small quantity of land is required, as it is computed that seventy-eight tuns of mulberry leaves will produce one million cocoons, and that three acres planted in mulberries will yield ninety tuns of leaves. Upon this basis a ten-acre lot will be ample for producing three millions of cocoons, leaving sufficient spare grounds for buildings, fruit, and flowers, without which, no place is fit to be called home. By this small subdividing, the community will have all the enjoyment of suburban life, with the benefits of churches, schools, lyceums, libraries, etc., etc., all of which are the necessary adjuncts to an enlightened, prosperous, and happy community."

Correspondence.

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

Power of the Crank.

MESSRS. EDITORS:—Your correspondent, J. W. H., on page 151, current volume, asks some questions in relation to the effective force of steam, at a given pressure, when applied at different points on the crank.

These are no new questions. Almost every mechanical student, at some point in his investigations, takes a tilt at the crank. When this attack is made with courage, and pursued with sufficient energy to really test the mettle, and bring out the qualities of this cranky old veteran, the valiant student surrenders, and embraces the ugly monster—the abrupt angles become lines of beauty, and no amount of argument or urging can induce him ever again to renew the attack.

I have thought that much of the mystery which envelops the movement of the crank, is thrown around it by the foggy explanations often given by our teachers. We are told of the "leverage" of the crank. We are lectured about levers of the "first power" and of the "second power," of "third and fourth powers." All such numerical terms applied to the levers and to the crank, tend to mystify rather than to elucidate the principles of their operation.

As a mechanical device, the crank is governed by the great laws that underlie and govern all mechanical devices. In transmitting motion, or power, it communicates just what it receives—no more, no less. It does this equally and exactly at all points, as well when in a line with the reciprocating mover, or when at right angles to it. To comprehend this truth, we need no harangues about the numerical powers of levers, but we must understand that to constitute a power, that is, force producing motion, two elements or conditions are requisite: First, an inclination to move; and secondly, space, or distance through which to move. The sum of these two conditions, is the measure of the power. Neither the one nor the other condition, alone, can exert any effective force.

In the steam engine, we have, as the first element of power, the pressure of steam in cylinder. This pressure is a tendency to move in all directions; but while it is held motionless behind the unmoved piston, it is mere statical pressure, and is no more a power than the cohesive strength of the iron that holds it is a power. When the piston moves, then the pressure becomes dynamical, and we have a power. Then if, as J. W. H. suggests, the pressure is 4,000 lbs., and the distance moved two feet, we have 8,000 foot-pounds; but if the distance moved is but one inch, the power is $4{,}000 \div 12 = 333\frac{1}{3}$ foot-pounds. And it must be carefully borne in mind that this is not only the measure of the power given off by the crank, but that it is also the exact measure of the power exerted by the steam.

I have said that the crank gives off at all points, the whole power that it receives. Of course the whole is not given off as effective work. Like all other devices, the crank must pay a tax to friction, and whether that tax is more or less on the crank than on other movements, is not what I propose now to consider. But the working of the crank, apart from friction, is the question.

J. W. H. complains that the crank gives no power "at either of the dead centers." Does it receive any at the dead point? While the piston stands still, does it cost anything? It, then, no power is expended on the crank at these points, none should be expected from it. But let us consider, for a moment, what is the effect when the piston moves forward.

We will take the engine as J. W. H. proposes, 24-in. stroke, 50 inches of piston area, with 4,000 lbs. pressure. When this piston has advanced one inch, the crank pin has passed nearly five inches, and has reached a point where the 4,000 lbs. on the piston will amount to 1,500 lbs. on the wrist. Now, if we carefully compute the pressure upon each inch of this arc, we will find their sums to make 4,000 lbs. raised one inch, or $333\frac{1}{3}$ foot-pounds. While the piston is moving the second inch, the crank moves about two inches; but a computation of the pressure on these two inches, will gives us $333\frac{1}{3}$ foot-pounds as before. Near the point of half-stroke, the piston and crank pin move in nearly the same line, and the pressure upon them is about equal; but here, while the piston travels one inch, the crank travels but one inch also, and as it has here but the 4,000 lbs. pressure and one inch travel, it gives still but $333\frac{1}{3}$ foot-pounds. We might follow this, inch by inch, through the whole stroke, and show that wherever the pressure is nearest to the line of travel of the crank, the movement of the wrist is least, and where the pressure is most indirect, the motion of the crank is greatest, so as to make the pressure and distance together, exactly equal at all points. The pressure on the piston being constant and equal to 4,000 lbs. per each inch moved, while that on the crank varies as the line of motion varies from that of the piston; but the distance traveled by the piston is everywhere just as much less than that of the crank as the pressure on it is greater.

Now if J. W. H. will take the distance traveled into the calculation, he will obtain the solution to his problem. He asks, "What number of inches of piston area will equal the above (the fifty inches as just considered) if applied six-sevenths of the entire circle, under same pressure of steam and same leverage of crank." About 37·5 inches of area would be equal in pressure to the fifty on the crank, but the travel, to make six-sevenths of a 24-inch circle, would be, in round numbers, 64 inches. With his arrangement, J. W. H. will have 37·5 inches area and 64 inches length; hence, will use $37{\cdot}5 \times 64 = 2{,}400$ inches of steam per revolution. With the crank, the travel of piston is 48, and the area 50 inches. Hence, $48 \times 50 = 2{,}400$ inches—exactly the same in both cases.

However much the friction may be lessened, or the motion regulated by applying the power regularly in the line rotation, it is clear that, apart from these, no power can be gained.

Keokuk, Iowa E. S. WICKLIN.

The Dynamic Lever.

MESSRS. EDITORS:—The "Dynamic Lever" man, who furnished the article at page 165 of your last number, signed F. R. P., has a kink in his brain which needs to be straightened out only for the purpose of saving him from wasting his thoughts upon a fruitless inquiry, but your columns from being further occupied with it.

He says, referring to the diagram which accompanies his article, there is a force of 70 lbs. at C in the direction of the motion of the boat, and that this force will propel the boat against a resistance of 70 lbs. Now, if this were true, under the circumstances, which he defines, we should have no further use for balloons and flying machines, since every man could at his pleasure, lift himself into the air by the waistband of his pantaloons.

As in celestial mechanics, the mutual actions and reactions of the bodies of a system have no effect upon the motion of the center of gravity of the system; so in terrestrial mechanics the mutual action and reaction between the connected parts of a structure have no effect to move the structure.

F. R. P. overlooks the fact that while there is a forward force of 70 lbs. at C, there is an equal and opposite reaction at the same point, and that these equal and opposite forces being both received upon the connected parts of the same structure neutralize each other, just as the upward draft upon the waistband of the pantaloons is neutralized by the down ward draft upon the hands. The point, C, is not the place where we are to find the force that propels the structure, but the point, B, where one of the equal and opposite forces is received upon matter which forms no part of the connected structure. There the force is 10 lbs., and it is capable of moving the boat against a resistance of 10 lbs. only.

These considerations, which are so simple and obvious that it would seem they could hardly need to have been presented, cover all cases of "dynamic levers" whether found in animals or elsewhere. B.

New Haven.

Manufacture of Glass by Rolling.

MESSRS. EDITORS:—I notice an article by Mr. C. Boynton, in your number for March 13th, under the head of "Window Glass," in which he asks "Why a pot of glass cannot be drawn out into sheets, as well as a continuous sheet of paper? and also asks, "Who is there that has capital, and spunk enough to try the experiment?"

In reply I would say that about twenty years ago Messrs. Chance Bros. & Co., of Birmingham, England (the largest window glass manufactures in the world), erected extensive works in London, for experiments in passing molten glass through two rollers (a patent for which had been obtained by Mr. Bessemer). After trying everything that ingenuity and skill could conceive of, it was found impracticable. Probably as much as £100,000 was expended in carrying on these experiments. The object of these trials was to make sheets of glass free from the undulations which are always presnt on the surface of blown window glass. Even had they been successful in rolling out the sheets, nothing would have been gained, as the surface of the glass would have been almost—if not quite—as undulating as the blown glass. This is apparent to any one who has seen the casting of plate glass, or to any one who will examine the smooth surface of a sheet of rough plate glass. The smooth side is the one over which the roller had passed, and which presents a very uneven surface. Did it pass between two rollers, of course both sides would be the same. To overcome the great defect in window glass, viz., the undulating surface, Mr. James T. Chance, one of the above named firm, invented ingenious machines for grinding and polishing such thin glass, after which process it is equal in effect to the expensive plate glass.

I believe it to be an impossibility to make sheets by passing the smelted glass between two rollers, and any one practically acquainted with the manufacture of glass, would, I have no doubt, agree with me.

Many reasons might be given showing its impractibility, were it worth while to mention them. I trust after reading this statement, Mr. Boynton may not think that it "seems to him to be a disgrace to American inventive genius that they have not accomplished that which is impracticable."

GEO. F. NEALE.

Lenox Furnace, Mass.

A Problem for Inventors—Plow Wanted.

MESSRS. EDITORS:—Possibly some of your readers—inventors—could invent or adapt a "breaking and turning plow" for our tough, heavy, and adhesive black and red lands, which—in consequence of the treatment they annually receive—require every spring to be as thoroughly "broken up," as they were when first reduced to cultivation. The treatment referred to, is that of pasturing all kinds of stock upon them after the crops are gathered, and during the winter, for scarcely any one, however practical, can refuse his stock the benefits of the luxuriant pastures which succeed our crops. Hence, they become greatly consolidated and indurated, requiring "re-breaking" every spring, and also, with the species of plows used, a much greater amount of horse or ox power than would be needed, were our plows exactly adapted to the work. As illustrative of the resistance these compacted soils present to the plows used, may be mentioned the fact that it requires four yoke of oxen to draw a Satlee gang plow of two plows. Yet these same lands, when properly broken up and submitted to the action of rain and sunshine, become so loose and mellow, or friable, as to be worked very easily the remainder of the season. All of the plows adapted to your light loamy lands present too much resistance in "breaking up" our heavy ones. They are too short and bluff up too much, and we are compelled to have manufactured locally, at much greater cost, a long plow with a wooden mold board, called a a "carey;" but this plow, better for the purpose than those imported from Northern manufactories, does not come up to the kind needed. The inventor should come and see the land in the condition it is when being broken up in the spring, in order to form a correct idea of the plow needed. It may be stated, that the plow that our heavy soils require, should be long, going into the land like a wedge, to which the resistance would be gradual and be distributed along the entire line of surface. Such a one as some agricultural writer describes as being used in the heavy stiff clay soils of Scotland. Some or the "carey" plows mentioned do fit the want, but as they are made, each one to the fancy or taste of the various makers, there is no certainty of the plow proving what is wished—so a cast or molded plow is needed.

A plow of the kind indicated, would, I am persuaded, upon due exertion and demonstration before our farmers, come into general use, and insure to to the inventor large demand and profits.

I am secretary (corresponding secretary) of the Montgomery county (Texas), Agricultural Society, and am authorized to write, etc., in its name, and so take the liberty of addressing you this letter.

C. B. STEWART,
Cor. Sec. Agricultural Society.

Montgomery county, Texas.

Transmission of Power—An Ingenious Device.

MESSRS. EDITORS:—I have given the subject of compressed air much study and attention for the past few years, and have made some practical applications, hence, I watch with much interest the progress made by others in its application to various useful purposes. I saw a few days since a very ingenious application of compressed air as a means of transmitting power to the point where it was to be used, and, at the same time, admitting of a motion perfectly free in any direction. The device alluded to was operated by a dentist of this place. It was a rotary engine on a very small scale. The compressed air to propel the engine was furnished by a small foot bellows, which was double-acting, being two common bellows joined together. It was twelve inches long, by seven wide, and two and one-half inches high, and was operated by the dentist without inconvenience. The engine was run at a very high rate of speed, which I have since seen tested, and also the power. The speed attained, when running, at about the usual rate, was four thousand per minute, by actual count, by means of two pairs of watch wheels, which reduced the motion sixty times. It raised a weight of one and one-half pounds over a pulley of one-fourth of an inch in diameter on the engine shaft. The air was conducted to the engine through a one-fourth inch rubber tube. It was evident that the friction of this little instrument must be very small, else the power would have been absorbed at that very high motion. The instrument was used to rotate small burrs to dress out and undercut the cavities in teeth before filling them, and to dress off the foil after filling. It also had a reciprocatory attachment for operating a small saw or file to cut between the teeth. The same motion was used for polishing. The engine formed a part of the instrument, and the whole together weighed but eight and one-half ounces. The dentist claimed that he could accomplish as much, by the use of this instrument in two minutes' time, as would have taken him one hour in the ordinary way. The applications are very numerous where this mode of transmitting power can be used with equal advantage and that too without the use of any gearing or belts to produce the motion desired. There are some other points which occur in the application of air to mechanical purposes to which I would like to call the attention of practical men. One is the construction of valves in the various pneumatic instruments. The principles which govern their operation do not appear to be generally understood. The same is also applicable to steam or gas under similar circumstances. The valves to blacksmiths' bellows are quite often at fault. I have known instances where the power required to operate the bellows of the same dimensions would vary one hundred per cent simply from the difference in the construction of the valves. A good illustration of the principles governing their operation may be had in the following experiment: Take a piece of board planed smooth on on one side, and bore a hole through it of suitable size to receive the end of a piece of rubber tubing from the under side of the board, not so large but that you can blow a sharp blast of air through it. Then take a common business card, punch two holes through one end of it, place the center of the card over the hole in the board, and stick a pin through the holes in the card into the board to prevent the card from moving sidewise. Now take the other end of the tube in your mouth and blow strongly. It will be found impossible to raise the card from the board, no matter how good a blower the experimenter may be. If not satisfied with this, and it is desired to try a higher pressure, the tube may be attached to a steam boiler, using a piece of rubber packing in place of the card, the result will be the same, except that the noise occasioned by the steam passing through the shallow space allowed will be much louder. I have tried the last experiment with a pressure of sixty pounds of steam. The steam or air will get out from under the card, but its passage will be very much obstructed.

In the construction of the valves to the various kinds of bellows and other pneumatic appliances, the evil consequences resulting from the above-mentioned cause may be obviated by raising the valve seat a half inch or more for large valves, and making the edge of the seat quite narrow. Another mode of exhibiting the same law may be seen by placing a piece of newspaper over a concave space three or four inches long, and from one to two inches deep. Then, by means of a small tube or gas pipe, direct a sharp blast of air through the concave space under the paper, which space should form something like a half circle. Hold the end of the tube about one inch back from the end of the space. If the blast is sharp enough, the paper will be at once drawn down very near the bottom of the space, leaving but a very narrow place for the air to get through under the paper.

I could add much more on the subject, and also give my version of its philosophy, but I am aware that my article already calls for more space than may be thought proper to give it. P. ANDERSON.

Kalamazoo, Mich.

Gold Leaf a Protection from Sunstroke.

MESSRS. EDITORS:—In No. 11, current volume of your journal, I notice among your list of recent patents, a patent for a "safety hat," the object of which is, to protect the head from the sun's rays by means of an absorbent of moisture, such as sponge, inserted in a double crown.

This object, it appears to me, may be attained more readily and scientifically, by following the suggestion of Prof. Walker, of Washington College, at Lexington, Va., whose idea is based upon the following experiment of John Tyndall, before the Royal Institution:

"It is wonderful what a slight and trivial thing will be sufficient to prevent the absorbtion of radiant heat. I have here an exceedingly instructive substance. It is a piece of paint * * * * a portion of which is coated with gold leaf, and though the gold leaf is infinitesimally thin, it has been competent to protect the surface of the paint from the action of radiant heat to which the whole thing was exposed, while the other part of the surface, which was not covered with gold leaf, has become blistered.

"I have here a sheet of paper covered on one side with iodide of mercury, a substance which has its color discharged by heat. On the other side of the paper there are certain figures represented by a thin coating of metal. I place the iodide of mercury side downwards, and over the other side I will hold a hot spatula which will radiate heat to the surface of the paper. Where the thin coating of the metal is, the heat will be rejected, but where the paper is not coated the heat will be absorbed and then it will reach the iodide of mercury on the other side and destroy its color." The experiment was successfully performed.

Professor Walker suggests that a thin coating of metal worn in the hat, would prevent the passage of the heat rays, and thus prove a protection from sun stroke. He finds that gold leaf applied to bobbinet and protected by silk illusion, or another fold of the former material, answers best, without inconvenience in weight, liability to tear, or stopping the aqueous evaporation from the head. G. W.

[The cheapest and best thing to do in summer is to put a cabbage leaf in the hat.—EDS.

Bread Again.

MESSRS. EDITORS:—Please accept our warmest thanks for the very good recipes and hints you have given on "bread making." "The staff of life," is certainly a subject worthy every lady's attention. If any of your lady readers wishes to read more upon the subject please give this "one more" recipe for their benefit. There are some families that must, and will, have warm biscuit every morning and evening, to such I say all that is necessary is to keep a jar of "bread sponge," made as thick as stiff batter; a quart of this and one teaspoonful of baking soda stirred stiff with flour so as to be molded, makes excellent biscuit for breakfast or tea. To renew the sponge every day, take one cupful of hop water or hop tea, three cupfuls of flour, three cupfuls of boiling water, one teaspoonful of salt, two teaspoonfuls of sugar and three teaspoonfuls of butter or lard, and after stirring all together pour into the jar to replenish it. The jar should hold at least twice or three times the quantity that is daily used out of it. H. B. M.

Extinguishing Kerosene Lamps.

MESSRS. EIDTORS:—I see in your paper many plans proposed for extinguishing kerosene lamps, all of which may be good, notwithstanding which, I send you a plan which I have adopted, and one I think perfectly safe, viz., turn the wick down until it is out, then turn it up ready for lighting. There is in this no danger from blowing "up," "down," or "across the chimney." C. LEAVITT.

Windsorville, Conn.

Contents of a Cylindrical Vessel in Gallons.

MESSRS. EDITORS:—On page 182, of present volume of your paper I notice a method for finding the number of gallons in a cylindrical vessel, communicated by M. T. St.——

The following method requires much less work, and is more accurate: Find the product of the square of the diameter, the hight, and 34. Point off four places from the right of this product and we have the contents in gallons to great accuracy.

Salem, Ohio. M. C. STEVENS.

Absinthe.

It appears that until 1864 the belief that there was nothing injurious in absinthe except the alcohol, was general enough. In that year, however, a mad doctor named Marce, communicated a paper to the Academy of Sciences, in which he demonstrated that the essence of wormwood was contained in the liquor called absinthe, in the proportion of twenty grammes of essence to 100 liters of alcohol, and argued that this essence had a peculiarly injurious effect on the brain. In 1867 a petition was presented to the Senate, praying that the sale of absinthe might be absolutely forbidden. Nothing came of it; and now the "question of absinthe" has been once more brought forward by two physicians, MM. Magnan and Bouchereau, who, for the first time, have made regular scientific experiments with the questionable stuff. The object of the experimentalists was to show what the effect of pure alcohol would be on a guinea-pig, and what the effect of absinthe. With this view, they placed a guinea-pig under a glass case, with a saucer full of essence of wormwood by his side, another guinea-pig being placed under another glass case with a saucer full of alcohol. The guinea-pig, who, so to say, was being "treated" with absinthe, sniffed at the fumes, and for a few moments seemed, like the ordinary absinthe drinker, "supremely happy." Gradually, however, he became heavy and dull, and at last fell on his side, agitating his limbs convulsively, foaming at the mouth, and presenting all the signs of epilepsy. The same epileptic symptoms were manifested on the part of a cat and rabbit, who, in a similar manner, were made to inhale the fumes of absinthe.

The Tea Plant.

A current item says: "The tea plant is now successfully cultivated near Knoxville, Tennessee, on the farm of Captain James Campbell. It is a deep evergreen shrub, and grows about five feet high. It is said that it can be raised in East Tennessee with very little trouble."

About ten years ago, the Agricultural Department of the United States Patent Office, expended several thousand dollars in introducing the tea plant to this country; and rooted plants were widely distributed. They were not expected to prosper in the North; but many were sent northward for trial, merely because of their novelty. In the South they should have lived, though neglected. Two were planted in a garden at the residence of T. C. Connelly Esq., No. 630 M street, north, Washington, and, to test their hardiness, they have been wholly unprotected through nine winters. Though not large they are healthy, and are full of green leaves at this time. It is often said that cheap labor in Eastern countries affords advantages forbidding our competition with them in producing tea. To this it may be properly replied that American skill is superior to Chinese labor. A tun of tea may be dried, or roasted, in a cylinder surrounded by a "steam-jacket," with less labor than a Chinese producer expends upon ten pounds; and the finger curling and the coloring are just what American tea drinkers do not desire. The aroma of certain plants and flowers is transferred to tea in China, in the process of manufacture; but this can soon be learned in practice. That people drink pure tea, but color and doctor it for the "outside barbarians."

Yellow-Wood.

This dyestuff is the wood of a tree which grows to a hight of from fifty to sixty feet, and is a native of South America and the West Indies. Its botanical name is *Broussonetia tinctoria*. The most esteemed variety is produced in the island of Cuba, and its comes to this country in blocks of about 1½ feet in diameter by 2 feet in length, weighing between fifty-six and a hundred and twelve pounds. It generally presents cracks and fissures in its substance, which are filled with a bright sulphur-yellow, mealy, coloring matter.

The Jamaica yellow-wood is next in value, but varies much in quality. That from Maracaibo is split into blocks of much smaller size. The European markets are supplied with this substance through the ports of the United States, Mexico, Central America, West Indies, and Brazil. The wood having been rasped into powder, the coloring matter is extracted from it by the simple operation of boiling in water. The extract of yellow-wood, or "Cuba extract," as it is sometimes called, is much used by dyers and printers in colors. It is sold in gummy lumps of a yellowish-brown color or in the shape of sirup, which is often largely adulterated by admixture of molasses. The chemical constituents of this dye are known by the names of *morin* and of *maclurin*.

Manufacture of Vinegar.

Dr. Artus has discovered a process for making vinegar from alcohol, which he says has proved entirely satisfactory. There is a very general complaint that the oxidization of spirits of wine in the vinegar process is far from complete, and that the results are not equal either in quality or quantity to what ought to be expected from the materials employed. Dr. Artus takes half an ounce of dry bichloride of platinum, and dissolves it in five pounds of alcohol; with this liquid he moistens three pounds of wood charcoal broken in pieces to the size of a hazel nut; these he heats in a covered crucible, and afterward puts them in the bottom of a vinegar vat. Here the platinum in its finely-divided spongy state absorbs and condenses large quantities of oxygen from the air by which the alcohol is rapidly oxidized. When the charcoal has been in use for five weeks it should be again heated in a covered crucible.

CARBOLIC ACID, it is stated, can be deodorized. Two parts by weight of gum camphor are mixed with one part of crystallized carbolic acid. After this compound has been well rubbed together, it is mixed with whiting, and in that form is said to be a valuable disinfectant and a good protection to furs in summer.

Philosophical Uses of the Beard.

The inhaling of metallic particles to which certain workmen are exposed, is replete with serious and lasting effects. In autopsies of persons who have died from pulmonary consumption, the lungs are frequently found filled with the substance belonging to the peculiar business which they have pursued during life. Cotton, in the form of dust, metal filings, chemical vapors, fumes of copper, arsenic, etc., are but a small number of the many substances which enter the lungs and finally destroy the lives of those engaged in such occupations. The lace weavers of Germany, and those occupied in the paper-staining factories are particularly exposed to these pernicious effects. Many temporary means have been tried to protect the artisans from such fatal consequences, but none have been found as effectual as the wearing of a beard and moustache. These and the hair which grows in the nostrils are found to be the best protection. All who have permitted their growth can testify to their efficacy in preventing the entrance of particles of dust, etc., and by a proper attention to cleanliness they will serve their purpose.

Corn Mills in Hungary.

The great mills in Pesth have nine pairs of stones, one above another, each pair set to grind more finely than the pair next above, and so the wheat; entering at the top of the mill, is roughly broken by the uppermost pair of stones, divided more effectively by the second pair, more triturated by the third pair, still more by the fourth pair, more and more finely granulated by the fifth, sixth, seventh, and eighth pairs, and finely reduced to a soft powder, flour, sharps, shoots, and bran altogether, by the ninth and lowest pair of stones. The product is precisely conformable to the views of the chemist, and, in addition, makes itself delightfully agreeable, instead of irritating, to the animal economy. Mechanically igenious, too, these mills are fitted with stones somewhat differing from those ordinarily seen in England and America. The eye, or central opening, is very large, so that all the grinding is done between the faces of the stones, far from the center, and therefore (as reason would point out) where the motion of the runner is most rapid.

Discovery of a New Mineral.

Bauxite is the name of a new mineral, which, it is stated, has recently been discovered in France. It is reported to be a hydrated oxide of alumina, in which iron has been replaced by alumina. The most remarkable peculiarity of this new mineral is the entire absence of silica, so that it does not resemble kaolin or potter's clay. Bauxite is employed in the manufacture of aluminum; it forms a soluble compound with baryta, which enables the manufacturer to obtain alumina free from iron. By fusing bauxite with soda ash an aluminate of soda is produced, which is extensively used in calico printing, and which could be employed in the manufacture of glass and of ultramarine. It is also proposed to fuse it with common salt, as a first step in a new process for the manufacture of soda ash. It is stated that a large establishment in Newcastle, England, prepares sixty tuns of sulphate of alumina every month from bauxite. They also make aluminate of soda and sulphite of alumina from it, the latter salt being of great value in the manufacture of beet sugar.

PARAFFINE WAX.—A correspondent of the *Public Ledger*, (Philadelphia), from practical experience, recommends lard and paraffine wax as the base of ointments used to dress running sores. It is stated that beeswax, the usual ingredient for giving consistency to the ointment, is melted by the heat of the body, and permits the humors to be absorbed by the linen bandages, which, therefore, in drying, adhere to the wound and cause great pain. Trouble of this kind, it is asserted, is entirely obviated by the use of paraffine wax. It may also be mentioned here, that a mixture of from one to three parts of coal tar with one hundred parts of fine plaster of Paris, well rubbed together and applied on lint, or used in a cataplasm, has a healing effect upon sores, and corrects the disagreeable odors from the suppurating surface.

IMPROVED SAFETY LAMP.—An ingenious self-extinguishing safety lamp, recently invented by M. Louis Dessens, consists in attaching to the wick holder a spring, the tendency of which is to draw it downward into the wick tube. One side of the holder, which is notched, passes through a slot in the tube, and is worked by a screw from below the oil chamber. There are a spring and pins, which permit of the closing of the lamp after it is lighted; but if any attempt be made to screw off the top, the spring is brought against one of the pins, and the unscrewing being continued, the wick tube revolves, taking the rack off the screw, and permitting the spring in the wick tube to draw the wick downward and extinguish the light.

SCARLET FEVER.—Dr. Budd, of Bristol, England, who has given a great deal of attention to the subject, recommends the anointing of the whole body, including the scalp, with olive oil twice a day, beginning when the white dry symptoms appear, commonly about the fourth day. This he declares will counteract the diffusion of the poison in the dry scurf of the skin. This is an old theory and was given many years since in the SCIENTIFIC AMERICAN.

A VALUABLE COMMENDATION.—The *Medical Investigator*, one of the most excellent of the American medical monthlies, published by C. S. Halsey, Chicago, in its issue for March speaks of us as follows: "The SCIENTIFIC AMERICAN is a journal that needs no praise. It is without a peer. It often has articles bearing directly or indirectly on medical science. We know of no better stimulus to a lethargic mind than its perusal."

SUSPENSION BRIDGE OVER THE OHIO RIVER, CONNECTING OHIO WITH KENTUCKY.—SEE NEXT PAGE.

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(Illustrated articles are marked with an asterisk.)

VIS VIVA AND INERTIA.

The exact import of the terms "vis viva" and "inertia," as understood by writers on physics, is difficult of comprehension by ordinary minds, and difficult to explain clearly when comprehended. An engineer of some note once remarked to us, "I know exactly what *I* mean by 'vis viva,' but I find it very difficult to tell it." We do not propose to here enter upon an elaborate discussion of the doctrines of "vis viva" and "inertia," but merely to notice some recent opinions published in the American reprint of the *London Chemical News*, and also a paper by Professor Henry Morton, on the "Resistance and Transmission of Motion," published in the *Journal of the Franklin Institute*.

Prof. Morton charges that the subject has been inadequately treated by some even of the highest authorities, an opinion with which we perfectly coincide. He says, "we say and know that 'vis viva,' or work done by a moving body, varies with the square of its velocity, while we know, by our previous reasoning, that the force expended in giving it that velocity, only varies with the velocity itself. Thus, the force of gravity will give a falling body a double velocity in a double time, during which it must have exerted a double force upon it. Here, then, we have a double force doing a quadruple work. Is this because, by some wonderful and recondite property inherent in 'velocity,' the double power has been indued with an again double efficiency? Many writers leave us to think so; but we, on the contrary, believe that the work done *only seems to increase* more rapidly than the power implied in the increased velocity, by reason of a *loss of efficiency* in the resistances, in the overcoming of which the 'work' consists, and in fact, that work in this sense, is no true measure of force."

This argument is most forcibly and clearly expressed, and is further sustained by reasoning and illustrations which evince close thought upon this abstruse subject. We would be glad to notice this able article more at length, but want of space compels brevity.

The *Chemical News* says, the statements in the works on physics in regard to "vis viva" and momentum, are in its judgment, not sustained by reason or experience. It denies that the power required to maintain a train or a ship in uniform motion, varies as the square of the velocity, and asserts that there is really no such mathematical relation, and there is no close approximation to it. It asserts, moreover, that the case of a ship is so different from that of the train, that many engineers, who strive to measure facts on a procrustean bed of simple mathematical formulæ, represent that the power required to drive a ship varies as the cube of the velocity; and and no experienced engineer will say that within ordinary limits of speed four times as much power is ever required to maintain a train at double velocity. It sums up the case by stating that as it understands the subject of "vis viva," it relates only to change in velocity, and does not apply to the maintenance of a uniform velocity after it has been once attained.

These papers are an index of the effort which thinking minds are now making to disencumber themselves of ideas originating in the old notion of occult force. The terms, "vis viva" and "inertia," were born of that notion; as their parent may be said to be at the last gasp, we say let them die also.

As soon as we shake ourselves free from these clinging errors, and discard the illogical language they have imposed upon us, we shall have "cleaned our path from briars." We shall have to come down at last to the simple fact that *motion is force, and force is motion*, that is, so far as the human mind is capable of comprehending force. Motion can only produce an equivalent amount of motion, and hence the only measure of an existing motion is a previously existing or co-existent motion. When we get on to this plane we have got out of the slough of metaphysics and are on solid ground.

HORTICULTURAL PROTECTION.

The proposed granting of patents for new horticultural varieties is meeting with some opposition. The *Evening Post*, in an answer to a correspondent upon the subject, arrays itself with the opposers of the measure. This correspondent, who signs himself "Præsidium," gives some quite valid reasons for granting such patents.

The *Post*, in its editorial, in discussing the subject, restates these reasons in a very uncandid manner. It says: "'Præsidium' presents three reasons for patenting garden products. First, because the author of a book has a copyright, and the inventor of a machine may obtain a patent, therefore the owner of a garden in which any plant may grow which he considers new, ought to have the exclusive right to cultivate that plant." This, after the previous remark, that "respect for the very worthy gentlemen who have devised and now support the plan, demands that both Congress and the public shall give their case a candid hearing," surprises us somewhat. What is claimed by Præsidium and all others who favor the granting of horticultural patents, is not that *because* copyrights are granted to authors, and patent rights to inventors of machinery and devisers of new chemical processes, they should also be granted to cultivators of new varieties without regard to the merits of the case. They claim, what the *Post* grants in a subsequent paragraph, that "it is true that the work of the gardener is often of a highly intellectual and scientific character. His selection of varieties for a cross, his devices in the treatment of his plants, with reference to soil, temperature, and all the varied circumstances of culture; his ready discernment of valuable modifications of every kind, and his ability to develop and strengthen them; all these require powers of a high order—powers which deserve a rich reward."

Is the *Post* ignorant that new varieties of value are more rarely produced by accident than are mechanical improvements? If so, let it study awhile the works of Darwin or Randall, and post itself in the mysteries of reproduction. It says the intellectual labor of the horticulturist, is analogous to that of the scientific investigator and discoverer, rather than to that of the practical inventor and producer. It was rather hard on the "analogies," which it characterizes as "Præsidium's stronghold," but it sees none between the work of the inventor and that of the scientific investigator. Evidently the *Post's* highest idea of an inventor is a man who whittles until he, by accident, gets his stick into a shape that suggests a possibility, and having got the idea of the possibility goes through a series of tinkering till he gets, if not what he sought, something that can be patented. Its idea of the production of new varieties is scarcely better, being, as near as we can infer from the article in question, that they can be obtained, *ad libitum*, by accident. Now any man who has grown up among flowers and fruits, and is aquainted with the laws of their growth, knows better than this. He knows also that within certain limits, judicious selection will enable him to approximate to a type previously determined upon, notwithstanding the *Post's* dictum to the contrary, and that it is as Præsidium claims, "a complete and exclusive expression of his inventive thought."

We have already expressed our opinion upon the desirability and practicability of granting such patents, and although our esteemed cotemporary deems it as absurd as would be the issuing of patents "upon mathematical processes, upon chemical affinities, upon new planets discovered by astronomers, or upon new laws of life announced by physiologists," we fail to see any grounds for so considering it. Indeed, if mathematical processes, new plants, or new laws of life, could be made to pecuniarily reward their discoverers, by the granting of patents upon them, we should be glad to see their labors thus recognized.

MECHANICAL TOYS AS A MEANS OF PRACTICAL INSTRUCTION.

He who will introduce toys with the double object of amusing and instructing will be a benefactor to the race. We are aware that many of the popular toys now in use, are based upon mechanical laws, and, in a degree, illustrate mechanical facts; but this elucidation is not a primary or principal object in their construction, and can be found generally, only by a close study or a partial dissection of the toy. It is not apparent to the casual observer; indeed, the object seems to be to conceal the mechanism and exhibit only the result, tempting the inquiring mind—one that likes to understand the why and wherefore, that "seeks to know where faith should trust"—to copy the example of the boy who burst the heads of his drum to see where the sound came from, or ripped the bellows to find the source of the wind.

From the great steam man to the flying top, from Maelzel's automaton chess player to the pasteboard acrobats and dancers, the source of power and its modes of transmission are concealed as much as may be. Yet this is the best, most valuable, most interesting exhibition of the device. Concealment is not knowledge; mystery is not wisdom.

The zoetrope or "wheel of life" is a play upon the organs of vision, a valuable exemplification of the science of optics. As such it is amusing, and bewildering. But how valuable it would be to show the action of machinery, to illustrate mechanical movements. A machine or its parts might, by its use, be presented in actual, or rather apparent motion, showing not only the parts of the machine and their relations, but also their action. Why could not the principle of the zoetrope be extended to exhibit, simultaneously to every individual of a large audience, the movements of machinery? Certainly here is room for invention, or, at least, improvement. This toy might be made a valuable aid to impart scientific and mechanical knowledge. The lecturer who first succeeds in introducing the zoetrope to his class, or audience, to illustrate mechanical movements will inaugurate a profitable and valuable means of imparting knowledge. These suggestions are worthy the attention of our inventors.

DETERIORATION IN THE MATERIAL AND WORKMANSHIP OF MANUFACTURED ARTICLES.

We have no sympathy with those who are perpetually bewailing the growing degeneracy of the race and regretfully mourning the "good old times," but, in one respect, at least, the facts give reason for their animadversions of the present compared with the past. The honor of the manufacturer is too often made entirely subservient to his avarice. Articles of common and daily use are made to sell, rather than to last; sham and cheapness are made to take the place of reality and worthiness; paint and putty are used to cover the lack of painstaking and patience; even labor-saving machinery is made to contribute its quota to the revenues derived from the practice of sham. The commonest articles of household use are shams compared with those made by our fathers.

Tin ware will not stand scouring. The brilliant array of tin vessels, once the pride of the housewife, is not readily attainable. The iron sheet, thin as vanity, is slightly washed with a pewtery solution that, always dingy, wholly disappears in a few weeks' use, and the cup, kettle, or pan shortly becomes a sieve, wholly worthless. In wooden ware it is no better. The pail or bucket is made of unseasoned or knotty lumber, bound with hoops of iron foil, and painted with a mixture of ochre and benzine, or washed with some earthy pigment dissolved in water. The tubs fall to pieces unless kept filled with water; the trays and mixing bowls are carved from green wood that splits after a few months' exposure to the kitchen atmosphere. Brooms are bound lightly with rotten twine, instead of being well secured with lasting wire; a cleanly housewife will use one up in a week. Blacking brushes are stuck together with glue and brads; the boots blacked with them bristle like the porcupine.

In the article of furniture—common furniture for the kitchen and dining-room—it is still worse. The chairs are a delusion and a snare; they are built for a race of pigmies, and if they hold together during six months' use the first removal from one habitation to another makes them a wreck. Tables are skaky in the legs, or have lumbago or spinal complaint their backs diversified with prairie scenery, a rolling surface. Bedsteads when once unjointed object to resuming their original fair proportions. The drawers of bureaus recede from the frame and laugh at the impotency of the lock bolt.

And so we might go on indefinitely, and give many other illustrations of the endless variety of shams, sham in material, sham in making up, and sham in appearance. The picture is not overdrawn. Let any one look back twenty or thirty years, and call to mind the Lares and Penates of his father's house, comparing its "fixings" with those now made, and he will see that the times have changed. The furniture bought by the newly-married couple, witnessed the gambols of a large family of children, and served to assist them in their life-start when grown up. New tin ware came at rare intervals, usually the result of the housewife's careful saving of worn-out rags. The advent of a new water bucket or wash tub was an event in the household; they were made to last, intended for use, and they fulfilled their destiny.

We do not believe that the making of money should be the highest motive to actuate the manufacturer; a reputation is really valuable, and in time it pays pecuniarily. We could point to a manufacturer of tin ware who, for twenty years and more, during which he has carried on his business, never allowed any article to go out from his concern which was not, in all respects, first class. He gets good prices, and has a steady custom, which has secured him wealth—wealth honestly earned. Is it not to be supposed that he values his good name as much as his dollars? Is it not as much a source of satisfaction as his accumulations of wealth? When honor shall guide rather than sordid avarice, when a "good name shall be chosen rather than great riches," we may hope a return of those "good old times" when honest workmanship was the workman's best recommendation.

THE CINCINNATI SUSPENSION BRIDGE.

(*See Illustration on preceding page.*)

Suspension bridges are of very remote origin. One mentioned by Kirchen, still in use in China, was built, according to tradition, in the year A. D. 65; it is 330 feet long, a roadway of plank supported by chains. Rope suspension bridges were built by the ancient Peruvians, and they have been used in Europe. The first iron suspension bridge was built in 1819, across the Tweed, at Berwick-on-Tweed, by Captain Sir Samuel Brown. It was supported by chain cables, six on a side, and its span was 449 feet. The same engineer constructed the Brighton chain pier and the bridge at Montrose. The former was built in 1823, having four spans of 255 feet each; the latter was finished in 1829, and nine years afterward was destroyed by a hurricane. The Menai suspension bridge was built by Telford in 1826. Its span was 580 feet, and hight above the water 102 feet. A violent gale produced such an oscillation that the chains were dashed against each other, and the heads of many of the bolts were broken. The chains were similar to those used on lathes, planers, etc., made of plates bolted or riveted together. The Conway bridge, connecting Chester and Bangor, also built by Telford, has a span of 327 feet. It was built in 1826. The Freyburg (Switzerland) bridge is suspended by wire cables, and has a span of 870 feet.

In the United States, the most remarkable suspension bridges are Ellet's Wheeling bridge over the Ohio, with a span of 1,010 feet; erected in 1848, and blown down in 1854. The Lewiston bridge, seven miles below Niagara Falls, built by E. W. Serrell, spanned 1,040 feet. Roebling's bridge, at the falls, spans 821 feet; McAlpine's new Niagara bridge has a span of 1,264 feet, and the proposed bridge to connect New York and Brooklyn is to have a span of 1,600 feet.

The bridge seen in the full-page engraving crosses the Ohio River from Cincinnati, Ohio, to Covington, Ky., and has a span of 1,057 feet, with an elevation of roadway of 103 feet. This elevation is the mean, extreme cold raising the bridge, by contraction of the cables, twelve inches, and extreme summer heat allowing it to sink the same distance. At a mean temperature of 60 deg. the hight is 103 feet. The foundations of the towers were begun in September, 1856. Work was suspended in 1857, and not resumed until 1863. The bridge was opened for travel for foot passengers Dec. 1, 1866, and for carriages one month later. At the water level the space between the towers on either shore is 1,005 feet. The floor of the bridge is composed of a strong wrought-iron frame overlaid with several thicknesses of plank, and suspended to two wire cables by suspenders placed every five feet. The suspenders are between the roadway and footpaths, the former being twenty feet and the latter seven feet wide. No lateral or transverse stays or gays are employed in this bridge, the requisite stiffness being assured by two wrought-iron girders extending from abutment to abutment, and running through the center line of the bridge, under and over the floor beams. One is twelve and the other nine inches deep, the former under the beams and the latter over, secured together and to the beams by bolts, thus making a combined and continuous girder of a depth of twenty-eight inches.

The base of each tower is 82 by 52 feet, with a hight of 165 feet to the spring of the arch. The towers are buttressed from foundation to top. On the Ohio side the substructure is similar to that proposed for the New York tower of the proposed East River bridge—a mass of timber work resting on compacted sand, and firmly bolted together, the whole infilled with concrete grouting. The depth excavated on this side was so great that most of the wells in the vicinity were drained. The total weight of one tower is estimated at 60,000,000 pounds.

The cables are two in number, twelve and one-third inches diameter, composed each of 5,180 wires of No. 9 gage, twisted *in situ*, and overlaid with No. 10 wire, the total weight of wire used being 1,050,183 pounds. Each cable rests upon cast iron saddles at the top of the towers, each saddle resting upon 32 rollers. The bridge is the work of the celebrated engineer, John A. Roebling, to whom we are indebted for the facts herein stated. The view in the engraving is taken from the Kentucky shore.

WHY DON'T BOYS LEARN TRADES?

This subject was treated on pages 169 and 183, current volume. We do not assume to dictate to correspondents either the subject or the style of their communications, nor do we wish to interfere in the arrangements the members of Trades Unions may choose to make. Yet, whatever good these organized combinations may be capable of accomplishing, it is certain that some of their regulations operate harshly on outsiders. Especially is this the case as regards apprentices. A letter from Baltimore, Md., evidently written by a female hand, says: "The main reason why more boys do not learn trades is owing to the fact that trades combinations (the greatest evil society has to deal with) fix the number of apprentices each employer is allowed to have, and unless the employing mechanics of the different trades break up these combinations effectually there is no remedy, and the number of good journeymen will become so scarce that mechanical business will remain stationary.

"A case in point in this city illustrates the working of these trades combinations. An employing tinman working about thirty hands, took a lad, the soon of a poor widow, promising to teach him the trade. Soon after he put him to the bench every journeyman left his work, demanding the dismissal of the boy, refusing to return until he was sent away. Although the proprietor stated the case to them, that he was the 'only son of his mother, and she a widow,' they were firm in their determination, and the lad was dismissed.

"This is only one case. Parents, after repeatedly trying to procure opportunities for their boys to learn trades to fit them for usefulness in after life, are compelled to get them into any hand-to-mouth employment rather than bring them up in idleness."

Another, writing from Pleasantville, Pa., says he is a foreigner, two years in this country, at home a clerk and bookkeeper. Here he has been employed in boring and pumping oil wells. He wishes to learn the trade of sign and carriage painting, but doubts procuring an opportunity. He asks advice.

In relation to the Baltimore correspondent's complaint, we cannot agree fully with its main proposal. We do not think employing mechanics should unite to break up the combinations of the workers. The principal objection to such combinations of workmen as now exist, is that they are composed of employés alone, and we cannot see that a combination of employers alone would be free from this objection. Capital and labor, the employer and employed, are not properly antagonistic; the interest of one is the interest of the other. These class combinations appear to us to be not only unnatural, but absurd. We can see no valid objection or insuperable difficulty in the way of harmonious combination of employer and employed—a combination, or society, that shall regulate, by mutual conference and mutual concession, if necessary, the status of different workmen, rate of compensation, rules for the admission of apprentices, etc. All this could, and can be done without injustice to employer or employed, and with advantage to the apprentice.

After all, however, we believe such cases of hardship as that mentioned by our correspondent are to be attributed not to trade combinations but to the lack of proper regulations defining the duties of apprentice and master. When a lad can enter a shop ostensibly as an apprentice, and, after six months or a year, leave and set up for a journeyman, it is not surprising that journeymen who have faithfully served their time object to the reception of apprentices. But legislation is unnecessary in this case; if employers and workmen would institute and enforce rules for the reception and training of apprentices, the difficulties that now hamper and embarrass employer, journeyman, parents, and would-be apprentices would disappear.

CONVERSION OF CAST IRON INTO WROUGHT IRON--THE HEATON PROCESS.

The discovery of a cheap and simple process for freeing cast iron from carbon has long been a subject of earnest inquiry on the part of scientific and practical men. Mr. John Heaton's process for making wrought iron and steel seems to be pretty generally admitted to be a most expeditious and thorough method, but it is still an open question in the minds of many whether it is sufficiently economical.

Our readers are already aware that the basis of the method is the conversion of the carbon by means of nitrates of soda or potash. He also claims the use of chlorates. The application of these oxidizing agents is to be made to the under surface of the molten iron, so that the oxygen may act from below upward through its mass. The nitrate or chlorate is to be placed in chambers within the receiver of the melted iron, which is made to revolve, so that the chambers may come under the molten metal, and the nitrate or chlorate may act through it. The surface of the nitrate or chlorate is protected from a too rapid action of melted iron by means of an iron plate perforated with numerous holes. Mr. Heaton says, that if the cast iron contains about five per cent of carbon, one hundred weight and a quarter of nitrate or chlorate will be sufficient for each tun of iron, and that the effect will be produced in three minutes. The same process may also be used for the conversion of cast iron into steel.

A hot dispute has arisen in regard to the relative merits of this process as compared with that of Bessemer, culminating in two actions at law against the editor of *Engineering*, a leading scientific journal in England. This plan has taken a most decided position against the merits of the Heaton process. Indeed, looking upon the contest with entirely disinterested optics, it has seemed to us that its position was untenable on scientific grounds, and that it desired nothing so much as the failure of the new method. Its language has been that of deprecation, and its spirit, as evinced in the course of the discussion, seemed any thing but candid.

The matter has, however, fallen into excellent hands, and has been investigated by Professor Miller, of world-wide reputation as a chemist, in connection with Dr. Mallet and Mr. Kirkaldy. Each of these gentlemen has made elaborate reports entirely favorable to the success.

Prof. Miller's preliminary report describes Heaton's process thus:

On the occasion of our (namely, his and Dr. Mallet's) visit to the works of Langley Mill, on the 10th of July, 1868, 6¼ cwts. of Clay Lane forge pig, No. 4, were charged into a hot cupola which contained no other iron; and immediately 6¼ cwts. of Stanton forge pig, No. 4 (produced from two-thirds of Northamptonshire brown ore, one-sixth of Chesterfield clay ore, and one-sixth of puddling cinder) were added, and the whole, when melted, was drawn off into a ladle, from which it was transferred to the converter.

The converter is a wrought-iron pot, lined with fire-clay. In the bottom of it was introduced a mixture of 169 lbs. of crude nitrate of soda, 40 lbs. of silicious sand, and 20 lbs. of air-slaked lime; but these proportions in practice are varied considerably. On the top of this mixture a cast-iron perforated plate, weighing 95 lbs., was placed. The converter was then securely attached to the open mouth of a sheet-iron chimney, and the melted iron from the cupola (sample of this marked No. 4) was poured in.

In about two minutes a reaction commenced; at first a moderate quantity of brown nitrous fumes escaped, these were followed by copious blackish, then gray, then whitish fumes, produced by the escape of steam carrying with it, in suspension, a portion of the flux. After the lapse of five or six minutes, an intense deflagration occurred attended with a loud roaring noise, and a burst of a brilliant yellow flame from the top of the chimney. This lasted for about a minute and a half, and subsided as rapidly as it commenced. When all had become tranquil, the converter was detached from the chimney, and its contents were emptied upon the iron pavement of the foundery.

The crude steel was in a pasty state and the slag fluid; the cast-iron perforated plate had become melted up and incorporated with the charge of molten metal.

The slag had a glassy, blebby appearance, and a black or dark green color in mass.

A mass of crude steel from the converter was then subjected to the hammer (No. 7).

About 4½ cwts. of the crude steel were transferred to an empty, but hot reverberatory furnace, where, in about an hour's time, it was raised to a welding heat, and forged into four blooms under the steam hammer, then rolled into square billets, which were cut up, re-heated, and rolled into finished bars, varying in thickness from an inch to five-eighths of an inch (No. 8).

Three or four cwts. of the crude steel from the converter were transferred to a re-heating furnace, then hammered into flat cakes, which, when cold, were broken up and sorted by hand for the steel melter (No. 9).

Two fire-clay pots, charged with a little clean sand, were heated, and into each 42 lbs. of the cake steel were charged. In about six hours the melted metal was cast into an ingot (10 B). Two other similar pots were charged with 35 lbs. of the same cake steel, 7 lbs. of scrap iron, and 1 oz. of oxide of manganese. These, also, were poured into ingots (10 C). The steel, 10 B and 10 C, was subsequently tilted, but was softer than was anticipated.

These results, on the whole, are to be considered rather as experimental than as average working samples. I have, therefore, made an examination of the following samples only:

No. 4.—Crude cupola pig. No. 7.—Hammered crude steel. No. 8.—Rolled steely iron. No. 5.—Slag from the converter.

I shall first give the results of my analysis of the three samples of metal:

	Cupola Pig. (No. 4.)	Crude Steel. (7).	Steel Iron. (8).
Carbon	2·830	1·800	0·993
Silicon with a little titanium	2·950	0·266	0·149
Sulphur	0·113	0·018	traces.
Phosphorus	1·455	0·298	0·292
Arsenic	0·041	0·039	0·024
Manganese	0·318	0·090	0·088
Calcium	——	0·319	0·310
Sodium	——	0·144	traces
Iron (by difference)	92·293	97·026	98.144
	100·000	100·000	100·000

It will be obvious from a comparison of these results that the reaction with the nitrate of soda has removed a large proportion of the carbon, silicon, and phosphorus, as well as most of the sulphur. The quantity of phosphorus (0·298 per cent) retained by the sample of crude steel from the converter which I analyzed, is obviously not such as to injure the quality.

The bar iron (No. 9) was, in our presence, subjected to many severe tests. It was bent and hammered sharply round without cracking. It was forged and subjected to a similar trial, both at a cherry red and at a clear yellow heat, without cracking; it also welded satisfactorily.

The removal of the silicon is, also, a marked result of the action of the nitrate.

It is obvious that the practical point to be attended to is to procure results which *shall be uniform*, so as to give steel of uniform quality when pig of similar composition is subjected to the process. The experiments of Mr. Kirkaldy on the tensile strength of various specimens, afford strong evidence that such uniformity is attainable.

I have not thought it necessary to make a *complete* analysis of the slag, but have determined the quantity of sand, silica, phosphoric and sulphuric acid, as well as the amount of iron it contains. It was less soluble in water than I had been led to expect, and it has not deliquesced; though left in a paper parcel. I found that of 100 parts of finely-powdered slag, 11·9 were soluble in water. The following was the result of my analysis:

Sand, 47·3; silica in combination, 6·1; phosphoric acid, 6·8; sulphuric acid, 1·1; iron (a good deal of it as metal), 12·6; soda and lime, 26·1. Total, 100.

The result shows that a large proportion of phosphorus is extracted by the oxidizing influence of the nitrate, and that a certain amount of the iron is mechanically diffused through the slag.

The proportion of slag to the yield of crude steel was not ascertained by direct experiment, but, calculating from the materials employed, its maximum amount could not have exceeded 23 per cent of the weight of the charge of molten metal. Consequently the 12·6 per cent of iron in the slag could not be more than 3 per cent of the iron operated on.

In conclnsion, I have no hesitation in stating that Heaton's process is based upon correct chemical principles. The mode of attaining the result is both simple and rapid. The nitric acid of the nitrate in this operation imparts oxygen to the impurities always present in cast iron, converting them into compounds which combine with the sodium, and these are removed with the sodium in the slag. This action of the sodium is one of the peculiar features of the process, and gives it an advantage over the oxidizing methods in common use.

We may hereafter allude to the reports of Dr. Mallet and Mr. Kirkaldy, both of which contain further matters of interest.

RUSSIA SHEET IRON.

We learn that a new company has just commenced the manufacture of this article at Brooklyn, N. Y., with every prospect of success. The peculiar color and polish of Russia iron is said to be due to the method of carbonization and thorough hammering. No country has yet been able fully to compete with Muscovy, on account of the greater cheapness there of unskilled labor; but some of our Yankees think they can do the work here for less money by substituting steam for human muscle. At any rate the attempt is now being made.

At the works in Brooklyn an engine of 200-horse power drives an automatic steam hammer weighing seven tuns. The rolled sheet iron is greased and arranged in packages of thirty or more sheets. Each sheet is about 2½ feet wide and 7 feet long. The packs are then run into an oven and exposed to heat until the surface has attained the proper degree of oxidization. The packs are then transferred to the hammer, all the sheets in the pack being hammered at once. The anvil is movable, and the workmen change the position of the pack at each stroke of the hammer so that every portion of the iron will be acted upon. We are informed that Russia iron of excellent quality is being produced at these works, and that the company has large orders in advance.

The machinery is from designs by Mr. Morris. The steam boiler is rather novel in construction. It consists of a circular water drum, and a corresponding steam drum, placed one above the other, and connected by a large number of small pipes arranged spirally. The fire acts upon these spiral pipes, and the boiler is said to generate steam with economy. The construction of the boiler is cheap and simple.

The boyish test of good steel or good tempered steel blades, made by breathing on the polished surface, and noting the time of the evaporation, has lately been claimed by a prominent English mechanic to be founded on correct principles.

Two hundred thousand dozen toy drums are manufactured in Paris every year.

BEET ROOT SUGAR.

No. II.

THE BEET.

Many varieties of the beet, *Beta vulgaris*, are known to botanists, some of these, the mangel-wurzels, being used as food for cattle and for other purposes; others, the garden beets, as edibles for the table, while quite a number are mere horticultural curiosities.

Among the first, we find the *white Silesian*, or *white sugar beet* which is the only kind at present used by sugar manufacturers. It has been chosen from among all others on account of its superior richness in saccharine substance and its comparative freedom from coloring matter.

Margraff, in the year 1747, was the first to discover sugar in this plant, and Achard, of Berlin, made the first loaf sugar from it. After 1812 the manufacture of beet root sugar became a regular branch of industry in France, from whence it has gradually spread itself over the whole of continental Europe, and has recently penetrated into the British Isles.

Crystallized beet root sugar is perfectly identical in composition with cane sugar, and is undistinguishable from it by the sight, the taste, or by chemical tests.

The average composition of French sugar beets, according to A. Payen, in his last treatise, on the distillation of the juice of this root, is as follows:

Water	83·5
Sugar, with traces of dextrine	10·5
Cellulose and pectose	0·8
Albumen, caseine, and other nitrogenous substances	1·5
Fatty matter	0·1
Malic acid, pectic acid, pectine, gum, aromatic substance, coloring matter, ethereal oils, chlorophylle, oxalate and phosphate of lime, phosphate of magnesia, chloride of ammonium, silicate, nitrate, sulphate, and oxalate of potash, oxalate of soda, chloride of sodium, chloride of potassium, pectic acid salts, sulphur, silica, oxide of iron, etc., together	3·0

Braconnot had found:

Water	87
Soluble matter (sugar)	8
Insoluble matter	5
	100

Payen finds:

Water	83·5
Sugar	10·5
Various other substances	6·0
	100

Peligot says his experiments on French beets gave him an average of between 12 and 18 per cent of sugar; Krocker finds 13·3 for German sugar beets.

The percentage of sugar in American grown beets is highly satisfactory, as is shown by many analyses which have been made of them, as recorded by Grant, Blodget, and others. Roxbury beets contained 11·2 to 12·6 and 13·1 per cent of sugar; Dedham beets, 10·2; Shirley beets, 12·6 to 14·3; Deer Island beets, 10·4; Chatsworth beets, 9·12, 12·5, and 14; Hackensack beets, 14·4 to 17·6 per cent of sugar. The general average is 12·9 per cent of sugar, which, by recent processes, ought to furnish 10·3 per cent of raw sugar to the manufacturer.

The quantity of sugar in beets varies more or less according to the nature of the soil, the method of cultivation, the meteorological status of the season, and the nature of the fertilizers employed, all of which we shall practically discuss in our next article.

The average crop to the acre, grown in any one locality, does not seem to differ very materially from one year to another, as is shown by recorded experiments.

In various parts of France, Boussingault finds that this average is:

For the department of Pas de Calais	14 tuns to the acre.
" Aisne	11½ "
" The Nord	16 "
" Cher	17 "
" Seine et Marne	13½ "

Gasparin gives the present average for the north of France as 40,000 kilogrammes to the hectare or about seventeen tuns to the acre.

In Belgium the average crop is 18 tuns to the acre. In 1867, the product of beets, for the German Zollverein, was 23½ tuns to the acre, the total supply being grown on 239,775 acres, and producing 4,000,000 quintals of sugar.

To arrive at a definite conclusion as to the average product of sugar beets per acre in the United States, we have had to gather notes from many different authorities, whose names and places of residence we here furnish so as to substantiate our figures. They are: 1, A. P. Goodridge, of Worcester, Mass.; 2, S. D. Smith, of West Springfield, Mass.; 3, W. Birnie, of Springfield, Mass.; 4, T. Messinger, of Long Island, N. Y.; 5, P. T. Quinn, of Newark, N. J.; 6, I. C. Thompson, of Staten Island; 7, Emory Rider, of Hackensack, N. J.; 8, the Hon. Ezra Cornell, of Ithaca, N. Y.; 9. W. H. Belcher, of St. Louis, Mo.; 10, Theod. Gennert, of Chatsworth, Ill.; 11, Maurice Mot, of Cherry Valley, Newark, Ohio; 12, the late John W. Massey, of Morris, Ill.; 13, John W. Walsh, of Chicago; 14, T. Payson, of Deer Island, Boston Harbor; 15, E. B. Grant, of Boston; 16, M. Ogden, of the Illinois Central Railroad; 17, Agricultural Department of the United States; 18, D. L. Child, of Northampton, Mass.

We exhibit in a tabular form the results of the experience of the above-named parties, the numbers in the table corresponding to those preceding their names:

	1	2	3	4	5	6	7	8	9
Tuns per acre	17¼	17	34	49½	25	30	20	20	—
Cost of production per tun	$4·05	2·23	2·36	1·15	0·64	0·84	0·70	1·50	2·00

	10	11	12	13	14	15	16	17	18
Tuns per acre	—	—	20	15 to 42	—	20	20	—	13
Cost of production per tun	$3·00	2·65	1·50	2·00	3·50	1·38		2·60	3·00

We see by these figures that the lowest estimate of beet production in America is rated at 13 tuns to the acre; the highest at 49½ tuns, and that the general average is 24·48 tuns. We further notice that the lowest cost of growing beets was 64 cents per tun; the highest, $4·05, and the general average $2·42 per tun. Multiplying 24·48 tuns by $2·42 we perceive that the cost of growing one acre in sugar beets would average $59·24 for the whole country.

The farmer selling his beets at $3·50 would clear a profit of $26·44 to the acre.

For fear of being taxed with exaggeration, we shall, in all future estimates, average a United States crop at 20 tuns to the acre, the cost of production at $3 per tun, and the percentage of sugar at only 8 per cent, instead of 10·3 per cent.

According to the reports of the Commissioners of Agriculture, the average yield and cash value of grain crops per acre in the United States during four years, from 1862, to 1865 inclusive, was as follows:

	Bushels.	Price per bushel.	Value per acre.
Corn	32·99	$0·86	$28·37
Wheat	14·34	1·57	22·44
Rye	15·04	1·03	15·98
Oats	28·56	0·58	16·52

So that the *total* average *value* of a crop of grain gathered on one acre of land in the United States was only $20·87, or considerably less than the *net profit* to be derived from the sale of the beet roots made on the same extent of ground.

In France, the ratio of growing and harvesting a crop of beets, compared with that of growing and harvesting a crop of wheat is as 42·75 to 35, or in other words it costs 22 per cent more to produce one acre of beets than it does to cultivate one acre of wheat.

The proportion of leaves to roots in beets varies from 50 to 78 per cent by weight.

The elementary chemical composition of the plant is, according to Gasparin, as follows:

	Dry root.	Dry leaves.
Carbon	42·75	38·11
Hydrogen	5·77	5·10
Oxygen	43·58	30·80
*Nitrogen	1·66	*4·50
Carbonic acid	1·00	
*Sulphuric acid	0·10	
*Phosphoric acid	0·37	
*Chlorides	0·32	
Lime	0·42	
Magnesia	0·28	
*Potassa	2·51	
Soda	0·37	
Silica	0·52	
Iron and alumina	0·15	

Those substances marked with stars have to be furnished by the fertilizers, which, it will be noticed, will have to be rich in potassa and phosphoric acid, and must furnish 0·21 per cent of nitrogen to every 100 lbs. of root and 0·45 per cent of nitrogen to every 100 lbs. of beet leaves produced, unless these last are returned to the soil, which would diminish the quantity of nitrogen needed, by the weight of what they contain of this substance. The quantity of water in beet roots varies from 83 to 88 per cent.

According to Boussingault, four pounds of beet are equal in nutritive power for feeding purposes to one pound of dry hay; according to Count de Gasparin, five pound of roots equal one pound of hay.

Beet root pulp, after it has been pressed for the extraction of the juice, has the same value as the original root which produced it, weight for weight, so that its price may readily be established on the basis of 4½ lbs. pulp being the equivalent of one lb. of hay; that is, 100 lbs pulp equal to 22 lbs. good hay.

If 20 tuns of beet are made to the acre, and if the weight of pulp averages 18 per cent of that of the beet roots, we find 8,064 lbs. of pulp (equal to 1,774 lbs. of hay) to the acre, to be available for the purpose of feeding or fattening live stock.

The growing and harvesting of one acre of beets need 46 days of human (partly children's) and of 14 days of horse labor. In the West Indies one acre of sugar cane necessitates 172 days of human labor.

In our next issue we shall furnish practical details for the cultivation of the sugar beet, with the necessary conditions of soil, climate, and manure suited to its proper development.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

There is said to be a great and very profitable salt mine in the lands occupied by the Choctaw nation, and within a few miles are several hundred acres of land underlaid with coal of a fine quality, enough to supply the whole country for a hundred years.

India has had a curious railway accident. An elephant, seeing the red light and the smoke, concluded that the noisy locomotive was an enemy to be summarily demolished. He accordingly placed himself on the track, and met the strange creature head on, with trunk and tusks. The result was a dead elephant, and eleven cars capsized.

The communication between France and England by telegraph, were recently said to be entirely cut off. It is now officially stated that of the five cables which connect France and Belgium with England, two had been ruptured by the tempest, and that the land communications which join the three others on each side of the channel had also been broken.

The Chicago *Journal of Commerce* says, a man in Des Moines, Iowa, has erected a dwelling house for himself, built mostly of paper. The weather boarding, inside walls, and shingling, are of that material known in the West as the "Rock River Company's Building Paper." The cost is about two-thirds that of the ordinary materials, and the house, it is said, is much warmer than where plaster and wood are used.

The Chicago *Journal of Commerce* estimates that 1,656,708,538 feet of lumber, exclusive of laths, pickets, and shingles, were manufactured in Michigan in 1868. Saginaw leads off with 457,396,222 feet; Muskegon comes next with 245,000,000, and Manistee third with 155,000,000.

The Southern Pacific Railroad, says the San Francisco *Bulletin*, cuts one of the richest mineral belts in the world, in California, Arizona, and New Mexico. The road will thread its way among gold, silver, and copper mines.

Unionville, in Hartford County, has water power estimated to be equal to 4,000 horses. This drives the machinery of two grist and saw mills, one wood-turning shop on a large scale, three large paper mills, one musical instrument shop, one each of nuts and bolts, saws, straps, carpenters' tools hooks and eyes, foundery and plow and machine shops.

A Hartford company have recently made several steam gongs six feet, high and sixteen inches in diameter. We hope they will not "all speak a once" while we are around.

A firm in Springfield, Mass., turns out 400,000 gross of patent steel watch keys, besides jewelers keys, combined knife and tweezers, and other notions.

Three Dubuque miners have struck a lead lode, the sheet of mineral in the cap of which is two feet thick, and mineral shows in all directions in the black mud. The *Herald* says the prospect rivals the richest of the day.

The value of the boots and shoes made annually in Massachusetts, is said to foot up the enormous sum of one hundred millions of dollars.

Kansas boasts that its salt springs are inexhaustible and produce the purest salt of any in the United States.

Great activity in copper mining stocks is reported since the passage of the copper tariff.

Thirty miles above Cairo, in the Mississippi, there has been discovered a fine coal seam, four feet thick, width undetermined.

About seventeen thousand bushels of coal are daily mined in Rock Island county, Illinois.

Chicago has nearly sixty miles of Nicolson pavement.

Chicago shipped last year forty million bushels of wheat.

A company in Springfield, Mass., make 125,000 paper collars daily.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

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

☞ *All reference to back numbers should be by volume and page.*

M. N. R., of——It is difficult to designate a book teaching a machinist the "science, reasons, and demonstration of his business." Such information is scattered in a number of publications. Hand-books and manuals, together with works on natural philosophy, and Byrne's Dictionary of Engineering, or similar later publications, will be useful as aids.

J. B. C., Jr., of N. Y., asks for the rules for setting Stephens' cut-off. We never knew this cut-off to be set by measurement; it is done usually by trial, setting the engine on its centers, covering the ports, etc. No instruction (verbal) could give you the knowledge desired; the work belongs to an experienced engineer.

J. W. H., of Iowa asks "what is the expansive force of steam when cut off at half stroke, the pressure being eighty lbs per square inch?" The average pressure is 67·7 lbs., less 10 per cent allowed for attenuation of steam.

J. B. S., of Ind.—We cannot give the actual power of a turbine wheel unless we know its style, size, and the amount etc. of water used. Some builders claim a yield of 90 per cent of the power applied For reply to your other question we refer you to answer to "H. & Co., of W. Va." on page 204, current volume.

J. E. B., of Ind.—Portable engines as usually built—the best class—are as light as they can be, unless the boiler be made of sheet steel and all the connections, shaft, etc., also of steel. It is a fact that the larger the engine the less its proportional weight. We know nothing about the engine you refer to weighing only 16 lbs. to the horse power.

T. S. B., of Mo.—The oil of tobacco may be removed in a great measure from an old meerschaum pipe by boiling it in melted tallow and wax, say about equal parts of each.

T. B., of Ill.—The less the specific gravity of coal oil is, the more inflamable it is, but we are not aware that any exact relation between the specific gravities of such oils and the temperature at which they will ignite has been established.

H. C of Toronto, Ca.—The amount of gas obtained from a tun of coals, varies very much with the kind of coal used, and the way in which the distillation is performed. It varies from 6,500 cubic feet to 15,000. Boghead cannel is according to Hughes the richest in illuminating gases. To give the average of all the varieties would involve considerable computation. An allowance of 25 per cent is made by some authorities for losses by leakage, condensation, etc., but we believe that in well managed works this is too large.

N. O. H., of Minn.—According to De Saussere, freshly burned boxwood charcoal absorbs ammonia 90 parts of its own bulk; hydrochloric acid 85 parts; Sulphurous acid 65 parts; Sulphureted hydrogen 55 parts nitrous oxide 40 parts; carbonic acid 35 parts; olefiant gas 35 parts. Carbonic oxide 9·4 parts oxygen 9·2 parts; nitrogen 7·5 parts; marsh gas 5 parts; hydrogen 1·7 parts. Soluble glass is made by melting together in a Hessian crucible, 8 parts of carbonate of soda, or 10 of carbonate of potash, with 15 of pure quartz sand, and 1 of charcoal. The materials should be perfectly fused, and remain so for some time. They should be poured out before cooling into an iron vessel as otherwise it may be difficult to remove it from the crucible. It dissolves in from 5 to 6 times its weight of boiling water. It is a cheap material for lining cisterns, and is said to serve the purpose very well.

W. M., of Conn., asks if we know of any steam engine without "dead points" (single engine referred to), and if constructed, simple in its parts and certain in working, it would be valuable. We have never seen such an engine. We have seen some that *claimed* to be without dead points (*i.e.* points where no power was delivered), but never saw either a reciprotating or rotary engine of that character. If you can build such an engine, "simple" and "certain" etc., trot it out. It will pay as a curiosity, if it is otherwise valueless.

W. S. T., of Ill., superintendent of works employing steam power, says he has tried every advertised means, or substance, to prevent incrustations on his boilers (the water being limy), without avail, until he used white oak bark, or rather poles of that wood, and since that has had no trouble. He advises others using water impregnated with lime to do likewise. We cannot see the connection. The oak bark contains tannin and quercitric acid, neither of which we understand affects lime, unless this acid may combine with the lime to make a soluble salt. Certainly however, the oak saplings will not injure the boiler, and the remedy is simple and inexpensive enough to warrant a trial.

F. W. K., of Ill.—There *are* instruments made for the calculation of power transmitted by belts. One is the dynamometer of James Emerson, Lowell, Mass., illustrated and described on the first page of No. 1, current Vol. Scientific American, and another Neer's dynamometer, also described and illustrated on page 296, of Vol. XVIII, same paper, address being Geo. C. Roundey, 254 Broadway, New York city. The steam engine indicator is another method of determining the power transmitted by belts.

W. Y., of Mo.—Cooley's recipes are considered usually reliable. Your failure is probably due to impure materials. The best cement we know for glassware is that sold as the "Diamond Cement," imported from England.

J. J. W., of New Brunswick, says he derives great benefit from surface blow-off pipes for his boilers, which use salt water. He first tried them over the furnace, the hottest part of the boiler, but had much better success when he removed them to a cooler part of the boiler, having noticed the scum on the surface of water in a boiling pot to flow away from the point of ebullition. His pipes are plugged at the ends and pierced with small holes, the inner ends of the pipes being the highest. The plan is a good one, but if the pipe is jointed just inside the shell of the boiler and provided with a float to keep it always at the surface of the water the result is still more satisfactory. The blowing off should be attended to at least once a day.

C. C. L., of Ohio, sends us a sketch of a portion of the common hot water boiler usually placed in dwellings in connection with ranges and furnaces. He does not understand the necessity of the supplementary pipe connecting the hot water draw-off pipe above the boiler and the cold water delivery pipe at the bottom. It is evident that when the boiler is full, the cold water supply pipe—which descends through the top of the boiler to within a few inches of the bottom—will supply no more water until some of that in the boiler is drawn off, and, of course, circulation inside the boiler ceases. To keep up this circulation under these circumstances it is necessary to connect the hot water pipe with the cold water pipe that passes the water through the fire or heater. Of course, this cirlation is, in a degree, an element of safety. Every boiler, however, should be provided with a safety valve, loaded simply to the pressure necessary to raise the water the required hight within the limits of the boiler's resisting strength.

A. E. W., of Ill.—We are sorry to say that there are not, to our knowledge, any published data on the resilience of springs. There is no reason why experiments could not be made and the results arranged in tabular form. It would be not only of very great general value, but would bring money and fame to the experimenter.

C. A. L. of Tenn.—Rock or swamp maple is a better step for a turbine than either lignumvitæ or elm. It will sustain the weight of any turbine built. Cast iron is worthless for the purpose. Don't try it.

I. N. S., Jr., of N. Y.—We have once or twice given the process of blueing gun barrels and also pieces of steel. It is simply heating the piece to be blued in powdered charcoal over a fire until the requisite color is obtained. It will not injure the gun barrel if carefully performed.

P. M., of Pa.—A lath or shingle saw, properly fitted up, may travel at a speed that gives a velocity to its edge of 11,000 or even 12,000 ft. per minute. See answer to "H. & Co., of W. Va.," on page 204 current volume for calculation of number of revolutions required. The rule is; divide the circumference in feet by the speed desired—9,000, 10,000, or even 12,000 feet—and the quotion is the number of revolutions.

J. P. J., of Mass.—Alabaster is a delicate translucent form of gypsum and easily contracts dirt and becomes soiled unless kept carefully under glass. When soiled it should be immersed in clear water four or five days, then in water containing a small amount of lime for about the same time, then rinsed in clear water and dried in the air. Wooden vessels should not be used as they may stain the work. If the work is jointed and the joints separate they may be re-united with plaster of Paris.

Recent American and Foreign Patents.

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

Lock for Sewing Machine Cases.—E. F. French, New York city.—This invention has for its object to furnished an improved lock, designed especially for locking piano and sewing machine cases, but which shall be equally applicable for other uses, and which shall at the same time be simple in construction and effective in operation.

Combined Planter and Cultivator.—W. C. Switzer, Nelsonville, Texas.—This invention has for its object to furnish an improved machine, combining in itself most of the instruments required for preparing the ground, planting the seed, and cultivating the plants, and which may be easily adjusted for the various uses for which it may be required, doing the work in all cases thoroughly and well.

Corn Planter.—W. H. Cox, Virden, Ill.—This invention has for its object to improve the construction of the improved corn planter, patented by the same inventor October 23, 1866, and numbered 58,988, so as to make it more convenient and effective in operation.

Car Coupling.—Thomas B. Smith and Acanthus Hinchman, Pleasant Hill, Mo.—This invention has for its object to furnish an improved car coupling, which shall be simple in construction, reliable and safe in operation, and which shall, at the same time, be self-coupling, so that the cars may be coupled without danger of injury to those making up the train.

Process of Extracting Saccharine Juices from Canes.—Horatio S. Lewis, Chicago, Ill.—This invention has for its object to furnish a simple, convenient, and effective means by which the saccharine juices may be conveniently, effectually, and thoroughly extracted from sugar canes, sorghum canes, etc., in such a way as to remove all the sugar from said canes, whether it may be in the form of sap or juice, or whether it may have become crystallized in said canes.

Attaching Tugs to Whiffletrees.—Chas. H. Nye, Elizabethport, N. J.—This invention has for its object to furnish an improved device for attaching tugs to whiffletrees, which shall be strong, simple in construction, easily attached and detached, and not liable to become accidentally detached.

Harrow.—George Heffner, Homer, Iowa.—This invention has for its object to furnish an improved harrow, which shall be so constructed that each part may be lifted to clear it of rubbish without stopping the team, and which will adapt itself to the form of the ground to be harrowed, so that no part of the ground may be left unharrowed.

Threshing Machine.—George M. Rhoades, Hamilton, N. Y., and Geo. B. Hamlin, Willimantic, Conn.—This invention has for its object to improve the construction of threshing machines, so as to make them more efficient in use and less liable to get out of order, or to be broken than the machines constructed in the ordinary manner.

Sail Cringle.—Charles Lucas, Brooklyn, N. Y.—This invention relates to a new and useful improvement in the article known as the "cringle" used on the sails of sea-going vessels and other water craft, for attaching the sail to the yards, and for other purposes.

Air-Tight Cans.—W. J. Gordon, Philadelphia, Pa.—This invention relates to a new and useful improvement in cans for preserving fruit and other articles, and for containing lye, paint, and all substances of a similar nature.

Harness Connection for Looms.—J. T. Holden, Elmwood, R. I.—This invention relates to a new and improved means for connecting the harness of looms to the treadles of the same, and is designed to supersede the ordinary strap connections now used.

Hand Dumping Cart.—William Farmer, New York city.—This invention relates to a new and improved wheeled vehicle for moving various commodities or articles; and it consists in the novel construction and arrangement of parts.

Device for Pulling Hop Poles.—O. B. Hale, Malone, N. Y.—This invention relates to a new and improved device for the purpose of pulling hop poles.

Car Heater and Ventilator.—Edward Himrod, Dunmore, Pa.—This invention consists in generating the heat in a separate and fireproof chamber, and discharging the heated air into the car through registers, the same pipes and registers being used for ventilation in warm weather.

Apparatus for Boring Hubs.—F. Jonas, Freeport, Ill.—This invention relates to a useful improvement in apparatus for boring hubs of carriage and wagon wheels, and for other purposes of a similar nature.

Self-rake Attachment for Harvesters.—Ezra Ames, Austin, Minn.—The object of this invention is to provide a simple and effective self-rake attachment for harvesting machines, and it consists in a novel combination of devices.

Sheet-metal Roofing.—J. H. Shimmons, Lawrence, Kansas.—This invention relates to an improved arrangement of the form of the sheets for making sheet-metal roofs, whereby the seams will admit of being bent in the required form without cracking the metal.

Harrow.—A. Hamilton Ballagh, Wesport, Mo.—The object of this invention is to provide a simple and effective harrow. It consists of a frame braced by a stay rod, and provided with a number of oscillating cross beams which bear the harrow teeth.

Attaching Carriage Wheels.—Levi Adams, Amherst, Mass.—The object of this invention is to provide a simple and effective means for securing wheels on their axles, and to provide a means of excluding the dust from the axle box of vehicle wheels.

Molding Sash Weights.—Wm. Ferguson and James Anderson, New York city.—This invention relates to an improved method of molding for casting sash weights, and molds for the same, whereby it is designed to provide a more simple and expeditious mode of molding, and to produce smoother and better weights, especially in the formation of the eyes of the same.

Truck for Plows, etc.—John G. Moore, Kingston, Ohio.—This invention relates to improvements in trucks, such as are employed in connection with plows or cultivators, to afford a means for the operator to ride while guiding them, whereby it is designed to provide a simple and cheap truck, more especially adapted for the purpose than those now in use, which may be readily attached to or detached from the plows or trucks.

Compound for Destroying Insects on Trees.—Joseph Bingaman, Jersey Shore, Pa.—The object of this invention is to provide a liquid, which will when applied to the roots of trees, destroy, any pernicious and other insects which may infest it. The ingredients are all cheap and easily obtained throughout the countrygenerally, and the compound has been proved by repeated and careful experiments, to operate in exterminating all insects which infest trees and shrubbery, and inflict damage thereto by stinging and boring the same.

Bridle bit.—J. Hout Minnich, Tuscarawas, Ohio.—This invention has for its object to construct a bridle bit, which can be used to readily manage and control even the wildest horse, and by which the habit of kicking can be readily broken. The invention consists in fitting the ends of the bridle bit through slotted plates, and in so connecting the bit with the reins, that it can readily be drawn up against the roof of the horse's mouth, and at the same time backward. Horses are thereby successfully prevented from holding the bit with their teeth, and can consequently be readily controlled.

Skate Sharpener.—John F. Cameron, Brooklyn, N. Y.—This invention relates to a new instrument for re-sharpening or re-shaping the running edges of skate irons, and consists of a grooved instrument which retains the grinding tool at the bottom of the groove, so that the iron is guided between the two flanges, to have the edge perfectly straight. The invention also consists in pivoting one plate of the holder to make the sharpening tool removable and reversible at will.

Spinning Frame.—Albert L. Sayles, Pascoag, R. I.—This invention relates to improvements in spinning frames, whereby it is designed to provide a means for lowering the ring rail previously to doffing the bobbins, and raising it again afterwards, so that the yarn may be wound on to the spindle to hold it and cause it to run up again on to the new bobbins, thereby saving the time and labor of threading the yarn through the travelers, and securing it to the spindles after doffing.

Gaiter Boots.—Emile Nougaret, Newark, N. J.—This invention relates to a new manner of arranging the elastics on gaiter boots, with a view of preventing their wearing out, and of facilitating their attachment. The invention consists in setting the elastics in front of the boot close together, so that a narrow strip of leather is left between them.

Mosaic Floor.—J. George Kappes, New York city.—This invention relates to a new manner of arranging the lower soft wood layer, of that kind of mosaic floors in which the ornaments are produced from very thin pieces of hard wood; and the invention consists in constructing the said soft wood layer of narrow pieces of bars, which are grouped together in such manner that the separate plates composed of such groups will not be able to shrink, so as not to displace the hard wood covering which is glued upon them. That class of mosaic floors herein referred to, and which is preferred on account of its cheapness, is as heretofore made, very apt to be destroyed by shrinking, the plates which constitute the lower layers being made of single pieces of wood. To prevent this, without materially increasing the cost, is the object of the invention.

Railroad Rails.—Perry Prettyman, Paradise Spring Farm, Oregon.—This invention relates to improvements in railroad rails, the object of which is to provide rails, whereby the cars may be secured against the liability of running off from the track, and to provide more durable rails.

Rivet Machine.—Joel Miller, Swedesboro, N.J.—This invention relates to improvements in apparatus for heading rivets by hand, and consists of a riveting die provided with a handle shank and discharger.

Machine for Making Seamless Tubing.—J. McCloskey, New York city.—This invention relates to improvements in apparatus for making seamless tubing, from molten metal, of copper, brass, lead, or other soft substance, that will fuse at a low heat, but is more especially intended for making lead pipe either tin lined or not.

Stone and Stump Lifter.—B. and M. L. Oliver, Brooklyn, N. Y.—This invention relates to improvements in machines for raising heavy stones for loading, pulling stumps, and for other like purposes, and has for its object to provide an arrangement where great power may be applied by hand, in a convenient manner, and the weight may be readily lowered after having been raised.

Lock for Wagon Brakes.—J. Hoke, Cordova, Ill.—This invention consists of an eccentric dog, connected to the brake lever and to which the brake is connected, working in a circular groove in a metallic sector plate by the side of the lever, so arranged that it will move freely with the lever, when drawn back to "brake up," but will bite in the groove and resist the strain of the brakes when the lever ceases its action on the dog, and also arranged to be disconnected from the said adhesion to the walls of the groove by a backward movement of the lever.

Milk Cooling Apparatus.—Ira Houghtling, Houghton, Mich.—This invention relates to improvements in apparatus for forcing air through milk and other liquids for cooling them; and it consists of a fan blowing attachment for vessels arranged to distribute the air throughout the liquid.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

Grate Bars for Furnaces.—Jacob C. Schlough, Easton, Pa., has applied for an extension of the above patent. Day of hearing, May 10, 1869.

Faucet.—Edward A. Sterry, of Norwich, Conn., has applied for an extension of the above patent. Day of hearing May 24, 1869.

Machine for Cutting Out Boot and Shoe Soles.—Caleb H. Griffin, of Lynn, Mass., has applied for an extension of the above patent. Day of hearing May 24, 1869.

NEW PUBLICATIONS.

The American Entomologist.

The March number of this valuable monthly comes to us, as usual, replete with interesting matter, and fully and beautifully illustrated. We notice, also, that it has eight additional pages of reading matter, including, among other things, a facetious article on our large Polyphemus Moth, a valuable and lengthy article on "Wasps and their Habits," "Do Toads Eat Worker Bees?" "Answers to Correspondents," Reviews, etc., etc. Published monthly, at $1·00 per annum, by R. P. Studley & Co., St. Louis, Mo.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

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A first-class engineering and machine firm, desirous of being represented in New York, can be treated with for the exhibition and sale of their manufactures, in a first-class locality, under unusually advantageous circumstances, by addressing B, Box 6, Postoffice, New York.

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Wanted — A first-class mechanical draftsman, or a young man—a good draftsman, of limited mechanical knowledge, who has talent worth improving, and who can be educated into our uses. W. T. Hildrup Harrisburg, Pa.

Gas Lighting!—"Office Manhattan Gas Light Co., New York, March 10.—This Company have purchased from Mr. J. W. Bartlett, of No. 569 Broadway, the right to use, in our district, his Patent Improved Torch and Key, for lighting and extinguishing street lamps." Charles Roome, President.

A Blacksmith, of steady habits, experienced in general forging and tool dressing, desiring a working situation, address Athens Foundery and Machine Works, Athens, Ga.

Engine Lathe Wanted—From 12 to 30-inch swing, by H. Lombard, San Francisco, Cal. Manufacturers of Engine Lathes please send circulars to the above address.

Wanted—Parties to manufacture brass or German silver cord attachments. Patent just allowed. Address R. d'Heureuse, Box 6344, N.Y.

Green lumber dried in two days. Also, tobacco, meal, and every substance, cheaply. Circulars free. H. G. Bulkley, 135 Fulton st., New York.

Envelope Machinery, of all kinds, wanted, new or second-hand. Address Box 3,341, New York, stating particulars and lowest terms.

Wanted—A machine capable of splitting 15 to 20 cords per day of hard, knotty wood, 2 feet long. Address Proprietor Harford Furnace, Md.

Cotton Mill wants competent machinist, well recommended. Could employ family. Box 2,638 New York.

Manufacturers of agricultural implements & shingle machines, send circulars and price lists to Jones & Jones, Terre Haute, Ind.

Keuffel & Esser's, 71 Nassau st., New York, the best place to get first-class drawing materials.

Agency Wanted—by a responsible party, who has good store room. Best reference. C. E. Roberts, 138 Lincoln st., Boston, Mass.

Saw Gummers, improved upsets, and other saw tools, manufactured by G. A. Prescott, Sandy Hill, N. Y. Send for a circular.

Mechanical Draftsman Wanted—A thoroughly competent man, on iron-bridge work. Bring specimens and testimonials. Salary $3 to $4 per day. J. H. Linville, 425 Walnut st., Philadelphia, Pa.

Gear-cutting Engine for sale. A new machine with large index table. Also, worm arrangement with full set change gear, accurately adjusted. Address Wm. M. Hawes & Co., Fall River, Mass.

Wanted—Parties to manufacture the spring-jaw wrench illustrated in this paper Nov. 18, 1868. Address Bradshaw & Lyon, Delphi, Ind.

One hundred-horse power Corliss steam engine for sale in good order. Address W. B. Le Van, Machinist, 24th and Wood sts., Philadelphia.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

Etching on saw blades—A cheap and rapid process wanted, to take the place of stamping name, etc. Must be small and neat throughout, and duplicate of each other. Woodrough & McParlin, Cincinnati, Ohio.

Inventors' and Manufacturers' Gazette—a journal of new inventions and manufactures. Profusely illustrated. March No. out. $1 per year. Sample copies sent. Address Saltiel & Co., Postoffice box 448, or 37 Park Row, New York City.

The manufacture of sheet and cast metal small wares is made a specialty by J. H. White, Newark, N. J.

The Magic Comb will color gray hair a permanent black or brown. Sent by mail for $1·25. Address Wm. Patton, Treasurer Magic Comb Co., Springfield, Mass.

For coppered iron castings address J. H. White, Newark, N. J.

For portable grist mills and mill machinery, address J. T. Phillips, No. 13 Adams st., Brooklyn, N. Y.

For sale at a bargain—a complete barrel factory, nearly new. Address Hartmann, Laist & Co., Cincinnati, Ohio.

Pickering's Velocipede, 144 Greene st., New York.

W. J. T.—We think the patent asbestos roofing manufactured by H. W. Johns, of this city, is the best substitute for tin or slate. It is cheap and easily applied.

Tempered steel spiral springs. John Chatillon, 91 and 93 Cliff st., New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Punching and shearing machines. Doty Manufacturing Co., Janesville, Wis.

Iron.—W. D. McGowan, iron broker, 73 Water st., Pittsburgh, Pa.

N. C. Stiles' pat. punching and drop presses, Middletown, Ct.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of Parker Brothers' Power Presses.

Diamond-pointed or edged tools for mining, working stone, or other hard substances. See advertisement, page 207.

Winans' boiler powder, N. Y., removes and prevents incrustations without injury or foaming; 12 years in use. Beware of imitations.

The paper that meets the eye of all the leading manufacturers throughout the United States—The Boston Bulletin. $4 a year

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Issued by the United States Patent Office.

FOR THE WEEK ENDING MARCH 16, 1869.

Reported Officially for the Scientific American.

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Patent Solicitors, No. 37 Park Row, New York

87,750.—CHILLED PLATE FOR ORE CRUSHERS.—John L. Agnew and Charles E. Wright, Negaunee, Mich. Antedated February 27, 1869.

87,751.—CHOCK FOR VESSELS.—C. G. Bachelder, Camden, Me. Antedated March 9, 1869.

87,752.—BED BOTTOM.—J. J. Baxter, Grand Rapids, Mich.

87,753.—HEEL CUTTER.—J. H. Bean, Marietta, Ohio.

87,754.—IMPLEMENT.—E. S. Bennett (assignor to himself and Justus Smith), New York city. Antedated Feb. 27, 1869.

87,755.—WATER-HOOK BOLT FOR HARNESS.—J. W. Bishop, New Haven, Conn.

87,756.—HAT HOLDER FOR PEWS AND SEATS.—J. M. Cain (assignor to George Cain), Lafayette, Wis.

87,757.—CURTAIN FIXTURE.—H. N. Chapman, Washington, D. C.

87,758.—DEFECATING SACCHARINE FLUIDS.—Wm. Clough, Cincinnati, Ohio. Antedated Feb. 27, 1869.

87,759. — REFINING AND DECOLORIZING SACCHARINE AND OTHER LIQUIDS.—William Clough, Cincinnati, Ohio. Antedated Feb. 27, 1869.

87,760.—BARREL HEAD.—J. A. Cook, Owego, N. Y.

87,761.—NUT LOCK.—J. R. Cribbs, Gardner, Ill.

87,762.—TREADLE FOR SEWING MACHINES.—H. G. Davis, New York city.

87,763.—FELTING MACHINE.—Rudolph Eickemeyer (assignor to J. T. Waring), Yonkers, N. Y.

87,764.—MACHINE FOR PREPARING AND FELTING TUFTED FABRICS.—Rudolph Eickemeyer (assignor to J. T. Waring), Yonkers, N. Y.

87,765.—SAFETY BARREL FOR WATCHES.—S. F. Estell, Richmond, Ind.

87,766.—GEAR CUTTER.—Charles Evotte, Paris, France.

87,767.—HANDLE FOR TABLE CUTLERY.—R. H. Fisher (assignor to Beaver Falls Cutlery Co.), Beaver Falls, Pa.

87,768.—CONSTRUCTION OF CHAIRS.—Robert Fitts, Jr., (assignor to the W. Heywood Chair Co.), Fitchburg, Mass.

87,769.—VELOCIPEDE.—F. B. Gardner and John Trageser, New York city.

87,770.—HARVESTER.—C. P. Gronberg, Aurora, Ill.

87,771.—COTTON GIN.—S. Z. Hall, Sing Sing, N. Y. Antedated March 3, 1869.

87,772.—STEAM GENERATOR.—J. G. Hamilton, Chicago, Ill.

87,773.—SHANK LASTER.—Fred'k Henderson, Marietta, Ohio.

87,774.—WRENCH.—H. W. Hewet, New York city. Antedated Feb. 27, 1869.

87,775.—WELL TUBE.—L. L. Himes, New Haven, Conn.

87,776.—MUCILAGE BRUSH.—M. W. House (assignor to himself and J. F. Forsyth), Cleveland, Ohio.

87,777.—CAR AXLE-BOX LUBRICATOR.—M. C. Hubbard (assignor to I. P. Wendell), Philadelphia, Pa., and said Wendell assigns one half his right to Thomas Sayles, Chicago, Ill.

87,778.—PUMP-ROD COUPLING.—H. T. Hunt, Titusville, Pa.

87,779.—PREPARING AND BLEACHING PAPER PULP.—W. C. Joy and John Campbell, Penn Yan, N. Y.

87,780.—BOLT-HEADING DIE.—Joseph Kaylor, Pittsburgh, Pa

87,781.—TICKET HOLDER.—C. H. Kimball, Chelsea, Mass.

87,782.—HORSE RAKE.—Joseph La Croix (assignor to himself and Edmond Richards), Chicopee, Mass.

87,783.—DEVICE FOR STEAM AND OTHER ENGINERY.—Peter Lear, Boston, Mass.

87,784.—REVERSIBLE DOOR LATCH.—Thomas Lyons, Hartford, assignor to Russell & Erwin Manufacturing Company, New Britain, Conn.

87,785.—DOOR HOLDER.—Emmons Manley, Marion, N. Y.

87,786.—TABLE CUTLERY.—Samuel Mason (assignor to Beaver Falls Cutlery Company), Beaver Falls, Pa.

78,787.—TABLE CULTERY.—Samuel Mason and Edward Binns (assignors to Beaver Falls Cutlery Company), Beaver Falls, Pa.

77,788.—LAST.—A. W. Merritt, Scituate, Mass.

87,789.—STEAM-ENGINE PISTON PACKING.—T. R. Morgan, Pittsburgh, Pa.

87,790.—GRATE.—James Old, Pittsburgh, Pa.

87,791.—SKATE.—J. W. Post, Castile, N. Y. Antedated Feb. 27, 1869.

87,792.—APPARATUS FOR RECTIFYING and DISTILLING SPIRITS AND OTHER VOLATILE LIQUIDS.—E. F. Prentiss and T. D. Prentiss, Philadelphia, Pa.

87,793.—PREPARATION FOR POLISHING METALLIC SURFACES.—C. M. Rowley, Chicago, Ill.

87,794.—DOOR BELL.—C. W. Saladee, Circleville, Ohio.

87,795.—GLASS MOLD.—J. C. Schaffer, Rochester, N. Y.

87,796.—AUGER BIT.—Henry L. Shailer, Deep River (Saybrook), Conn.

87,797.—FRUIT BASKET.—Daniel Sherwood and G. D. Dudley, Lowell, Mass.

87,798.—POULTRY COOP.—W. J. Sloan, Smith's Ferry, Pa.

87,799.—SKATE.—Phineas Smith, New York city. Antedated Feb. 27, 1869.

87,800.—SIGNAL LIGHT FOR STREET CARS.—John Stephenson, New York city.

87,801.—FLY TRAP.—J. E. Stone, Erving, Mass.

87,802.—MEDICAL COMPOUND.—Paul Oscar Robert Stroinski, Boston, Mass.

87,803.—MACHINE FOR VARNISHING FLOOR OILCLOTHS.—C. W. Strout, Hallowell, Me.

87,804.—PHOTOGRAPHIC ALBUM.—J. F. Tapley, Springfield, Mass.

87,805.—CASTING ROLLS.—R. C. Totten, Pittsburgh, Pa.

87,806.—FULLING MILL.—J. H. Waite (assignor to himself, Rodney Hunt, and D. B. Flint), Orange, Mass.

87,807.—HORSE HAY FORK.—C. E. Warner, Syracuse, N. Y. Antedated March 12, 1869.

87,808.—STOVEPIPE SHELF.—J. J. Watson and W. S. Pugh, Coatesville, Pa.

87,809.—COFFEE AND TEAPOT HANDLE.—William Westlake, Chicago, Ill.

87,810.—THREAD GUARD FOR SPOOLS IN SEWING MACHINES.—Geo. Wheelock, Washington, D. C.

87,811.—CORN SHELLER.—W. H. Whiterow and Wm. Detrick, New Albany, Ind. Antedated March 3, 1869.

87,812.—MANURE DRAG.—Daniel Wingenroth, Ephratah, Pa.

87,813.—STEAM-ENGINE VALVE GEAR.—Thomas Wosser, San Francisco, Cal.

87,814. — BREECH-LOADING FIREARM. — George T. Abbey, Chicago, Ill.

87,815.—ATTACHING CARRIAGE HUBS TO AXLES.—L. Adams, Amherst, Mass.

87,816.—BIT STOCK.—A. S. Alden, Chicopee, Mass.

87,817.—HARVESTER RAKE.—Ezra Ames, Austin, Minn.

87,818.—RAILWAY CAR AXLE.—John Armstrong, New Or- Orleans, La.

87,819.—HARROW.—A. H. Ballagh, Westport, Mo.

87,820.—COMPOUND FOR DESTROYING WORMS ON PLANTS.—D. A. Bingaman, Jersey Shore, Pa., administrator of the estate of Joseph Bingaman, deceased.

87,821.—FOOD FOR DOMESTIC ANIMALS.—M. S. Bringier, Ascension parish, La.

87,822.—SKATE SHARPENER.—J. F. Cameron, Brooklyn, N.Y.

87,823.—CARRIAGE WHEEL.—J. Coney, South Boston, Mass.

87,824.—WHEEL CULTIVATOR.—W. F. Coulter, G. Coulter, and J. A. Lanery, Hardinsburg, Ind.

87,825.—CORN PLANTER.—W. H. Cox, Virden, Ill.

87,826.—MACHINE FOR POLISHING NEEDLES.—C. O. Crosby, New Haven, Conn.

87,827.—VOLUTE SPRING.—M. R. Dand, Philadelphia, Pa.

87,828.—PUMP.—L. H. Davis, Newark, Del.

87,829.—FALL-LEAF EXTENSION TABLE.—J. Dourson, Columbus, Ohio.

87,830.—BRICK MOLD.—T. Ellis and W. A. Ellis, Philadelphia, Pa.

87,831.—HAND DUMPING CART.—Wm. Farmer, New York city.

87,832.—MOLDING SASH WEIGHTS.—W. Ferguson and James Anderson, New York city.

87,833.—SPINDLE WRENCH.—J. B. Fink, Freeport, Ill.

87,834.—LOCK FOR PIANOS, ETC.—E. F. French, New York city.

87,835.—ELECTRO-MAGNETIC ENGINE.—C. J. B. Gaume, New York city.

87,836.—WHIP MOUNTING.—J. R. Gillet, Westfield, Mass.

87,837.—LIQUID METER.—O. Gilmore, Raynham, Mass.

87,838.—BRICK KILN.—J. K. Good, Pequa township, Pa.

87,839.—DEVICE FOR OPERATING GATES.—David G. Goodall, Beloit, Wis.

87,840.—AIR TIGHT CAN.—W. J. Gordon, Philadelphia, Pa.

87,841.—MACHINE FOR MOLDING PAPER COLLARS.—S. S. Gray, Boston, Mass., assignor to American Molded Collar Company.

87,842.—GATE.—W. H. Griscom, Salem, N. J.

87,842.—TOWEL DRYER.—S. E. Grout, West Concord, Vt.

87,844.—DEVICE FOR PULLING HOP POLES.—O. B. Hale, Malone, N. Y.

87,845.—HARROW.—G. Heffner, Homer, Iowa.

87,846.—CAR HEATER AND VENTILATOR.—E. Himrod, Dunmore, Pa.

87,847.—WAGON BRAKE.—J. Hoke, Cordova, Ill.

87,848.—HARNESS CONNECTION FOR LOOMS.—John Taylor Holden, Elmwood, R. I.

87,849.—MOSQUITO NET.—J. B. Holmes, Philadelphia, Pa.

87,850.—PREPARING FARINACEOUS FOOD.—E. N. Horsford, Cambridge, Mass.

87,851.—MILK-COOLING APPARATUS.—I. Houghtling, Houghton, Mich.

87.852.—HUB BORING MACHINE.—F. Jonas, Freeport, Ill.

87,853.—MOSAIC FLOOR.—J. G. Kappes, New York city.

87,854.—BUTTON.—M. R. Kenyon, Providence, R. I.

87,855.—PLANTER AND SEEDING MACHINE.—S. S. Kimball (assignor to himself and J. F. Prescott), Laconia, N. H.

87,856.—HUSKING THIMBLE.—H. J. Kinsz, Greeee, N. Y.

87,857.—LANTERN.—T. Langston, Brooklyn, N. Y.

87,858.—PROCESS OF EXTRACTING SACCHARINE JUICES FROM CANES.—H. S. Lewis, Chicago, Ill., assignor to himself and O. H. Tobey, New York city.

87,859.—SAIL CRINGLE.—C. Lucas, Brooklyn, N. Y.

87,860.—FEATHERING PADDLE WHEEL.—W. R. Manley (assignor to himself and W. H. Webb), New York city.

87,861.—FEATHERING PADDLE WHEEL.—W. R. Manley (assignor to himself and W. H. Webb), New York city.

87,862.—MACHINE FOR MAKING SEAMLESS TUBING.—John McCloskey, New York city.

87,863.—RIVET TOOL.—Joel Miller, Swedesborough, N. J.

87,864.—BRIDLE BIT.—J. H. Minnich, Tuscarawas, Ohio.

87,865.—GRAPPLE FOR TUBES.—S. R. Mix and M. D. Wilder, La Porte, Ind.

87,866.—TRUCK FOR PLOWS.—J. G. Moore, Kingston, Ohio.

87,867.—DOOR SPRING.—E. L. Morse, St. Louis, Mo.

87,868.—WATCHMAKERS' TOOL.—C. E. Murray, Lock Haven, Pa. Antedated March 12, 1869.

87,869.—GAITER BOOT.—Emile Nougaret, Newark, N. J.

87,870.—ATTACHING TUGS TO WHIFFLE TREES.—C. H. Nye, Elizabethport, N. J.

87,871.—STUMP EXTRACTOR.—B. Oliver and M. L. Oliver, Brooklyn, N. Y.

87,872.—HARROW.—G. W. Pense and C. E. Lykke, Franklin Grove, Ill.

87,873.—RAILWAY RAIL SPLICE.—Perry Prettyman, Paradise Spring Farm, Oregon.

87,874.—THRESHING MACHINE.—G. M. Rhoades, Hamilton, N. Y., and G. B. Hamlin, Willimantic, Conn.

87,875.—FRUIT BOX.—A. T. Robinson and J. Shepard, Bristol, Conn. Antedated March 12, 1869.

87,876.—FIRE TONGS.—D. R. Russell, Carrollton, Miss.

87,877.—SPINNING MACHINE.—A. L. Sayles, Pascoag, R. I., assignor to E. C. Cleveland and J. M. Bassett, Worcester, Mass.

87,878.—CELLAR FOR PRESERVING BEER.—R. Schmid, Chicago, Ill.

87,879.—MORTISING MACHINE.—H. Selick (assignor to Geo. S. Meyers), Lewiston, Pa.

87,880.—OIL BOX FOR CAR AXLES.—Jacob F. Sharp, Wilmington, Del.

87,881.—SHEET METAL ROOFING.—J. H. Shimmons (assignor to himself and S. R. Mayberry), Lawrence, Kansas.

87,882.—CAR COUPLING.—Thomas B. Smith and Acanthus Hinchman, Pleasant Hill, Mo.

87,883.—THRESHING MACHINE.—Wm. H. Smith, La Crosse, Wis.

87,884.—PORTABLE FIREPLACE.—Alvah J. Sprague, Springfield, Mo.

87,885.—COMBINED PLANTER AND CULTIVATOR.—W. C. Switzer, Nelsonville, Texas.

87,886.—STEAM HEATING APPARATUS.—William H. Towers, Boston, Mass.

87,887.—TOY GUN.—Edward Trask, Fitchburg, and Chas. T. Ford, Salem, Mass. Antedated March 5, 1869.

87,888.—STEAM ENGINE OSCILLATING VALVE.—A. Trew, Union City, Ind.

87,889.—FURNACE FOR MAKING IRON AND STEEL.—J. G. Trotter, Newark, N. J.

87,890.—APPARATUS FOR EVAPORATING SALT.—Andrew Van-Horn, Brooklyn, N. Y.

87,891.—CIRCULAR SAW.—Jacob Weible and Henry S. Robinson, Detroit, Mich.

87,892.—DITCHING PLOW.—Washington West, Pecksburg, Ind.

87,893.—RAILROAD CHAIR.—William Wickersham, Boston, Mass.

87,894.—METHOD OF PREPARING COON SKINS.—Chester Williams, Jr., Alba, Pa.

87,895.—BACKGAMMON BOARD.—N. Bangs Williams, New York city.

87,896.—HARNESS ROSETTE.—Levi C. Wilson, Albany, N. Y.

87,897.—SOLDERING IRON.—J. Dana Wyman, Fitchburg, Mass.

87,898.—LAMP BURNER.—Joseph Bell Alexander, Washington, D. C.

87,899.—THILL COUPLING.—William S. Appleget, Cranberry N. J.

87,900.—BRANCH JOINT FOR WROUGHT-IRON WATER PIPES.—Phinehas Ball, Worcester, Mass.

87,901.—POTATO DIGGER.—William Beaty, Pontiac, Mich.

87,902.—HORSE HAY FORK.—Wilson H. Berdan, York, Mich.

87,903.—VESSEL FOR MAKING COFFEE.—Alfred Berney, Jersey City, N. J.

87,904.—MILK STRAINER.—A. A. Bingham (assignor to himself and Geo. McNamee), Cooperstown, N. Y.

87,905.—ALARM LOCK.—Frank Brewster, Cleveland, Ohio.

87,906.—VENTILATOR FOR RAILROAD WATER CLOSETS.—F. H. Brown, Chicago, Ill.

87,907.—DOOR AND GATE LATCH.—Louis Brumbach, Reading, Pa.

87,908.—SAWING MACHINE.—John Casson, Parish of Sheffield, England.

87,909.—ICE-CREAM FREEZER.—J. R. Champlin, Laconia, N.H.

87,910.—SAW.—William Clemson, Middletown, N. Y.

87,911.—DEVICE FOR PROTECTING YOUNG PLANTS AGAINST WORMS.—J. W. Colburn, Rose, N. Y.

87,912.—PUMP.—Geo. Cowing, Seneca Falls, N. Y., assignor to himself, John P. Cowing, Philo Cowing, and Marshall Cowing.

87,913.—CARRIAGE WHEEL.—Charles Cummings, Providence, R. I.

87,914.—POTATO AND CORN CULTIVATOR.—John M. Davidson Pulaski, Pa.

87,915.—SCREW NOZZLE FOR CANS.—Fred. W. Devoe, New York city.

87,916.—HEEL STIFFENING.—Alfred B. Ely, Newton, Mass.

87,917.—STEAM BOILER FURNACE.—Wm. Ennis, Philadelphia Pa

87,918.—GARBAGE BOX.—J W Evans and G. F. Godley, New York city.

87,919.—ROD OF CONNECTED HOOK-BLANKS FOR GAS-FITTERS' USE.—John Fellows and James W. Lyon, Brooklyn, N. Y.

87,920.—CORN SHELLER.—Philo Ferrier, Ypsilanti, Mich.

87,921.—WHIP-SOCKET AND REIN HOLDER COMBINED.—J. R. Finney, Youngstown, Ohio.

87,922—GAS BURNER.—Conrad Franz, Cincinnati, Ohio.

87,923.—CULTIVATOR.—James C. French, Monmouth, Ill.

87,924.—MACHINE FOR CUTTING NAILS.—John C. Gould, Oxford, N. J.

87,925.—COOKING STOVE.—James Greer and Rufus I. King, Dayton, Ohio.

87,926.—CARRIAGE WHEEL.—David Grim, Pittsburgh, Pa.

87,927.—CARRIAGE JACK.—J. H. Hadley, Boston, Mass. Antedated March 12, 1869.

87,928.—ROTARY STEAM ENGINE.—S. H. Hamilton, Bushnell, Ill.

87,929.—LATHE FOR TURNING SPOOLS.—J. T. Hawkins (assignor to Holt, Hawkins & Co.), Annapolis, Md.

87,930.—MACHINE FOR DAMPING, ETC., CLOTH.—Wm. Hebdon, New York city.

87,931.—TRUNK LOCK.—Louis Hillebrand, Philadelphia, Pa.

87,932.—SUPPORTING BANDAGE.—Ernst F. Hoffman, New York city.

87,933.—CHAIR FOR BABIES.—Carl Holtz (assignor to himself and Chas. Magnus), New York city.

87,934.—FLOUR SACKER.—C. B. Horton, Sand Bank, N. Y.

87.935.—TRUCK FOR MOVING PIANOS.—John Hoyt (assignor to Chas. French), Davenport, Iowa.

87,936.—VELOCIPEDE.—N. W. Hubbard, New York city.

87,937.—MANUFACTURE OF VEGETABLE PARCHMENT.—E. P. Hudson, New York city.

87.938.—HEAD PAD FOR HORSES.—Daniel K. Humphrey Buffalo, N. Y.

87,939.—HAND TRUCK.—Henry C. Ingraham, Tecumseh, Mich.

87,940.—BRACE FOR BITS.—W. A. Ives, New Haven, Conn.

87,941.—MECHANICAL TYPOGRAPHER.—Chas. F. Johnson, Jr., Owego, N. Y.

87,942.—INNER SOLE FOR BOOTS.—Charles P. Johnson, Jamaica Plain, and Freeman K. Sibley, Auburndale, Mass.

87,943.—SLEIGH.—C. P. Kimball, Portland, Me.

87,944.—FLOOD GATE.—Abraham L. King, Farmersville, Ohio.

87,945.—ANIMAL TRAP.—George W. Kintz, Rochester, N. Y.

87,946.—SURGICAL INSTRUMENT FOR CONVEYING MEDICATED POWDERS, AND DEPOSITING THEM ON INTERIOR CAVITIES.—Adolphe Marie Albin Laforgue, Caen, France.

87,947.—SEED SOWER.—James L. Linderman, Rockford, Ill.

87,948.—BED BOTTOM.—R. O. Lowrey, Salem, N. Y.

87,949.—THRESHING MACHINE.—Jacob Lutz, John A. Eberly, and Henry Becker, East Cocalico township, Pa.

87,950.—LITHOGRAPHIC PRINTING PRESS.—Auguste Hippolyte Marinoni, Paris, France, assignor to Richard M. Hoe.

87,951. — CULTIVATOR.—T. J. Marinus, Independence, Iowa.

87,952.—CARPET-CLEANING MACHINE.—William McArthur, Philadelphia, Pa.

87,853.—DEVICE FOR LOCKING NUTS.—Harvey McCown, Enon Valley, Pa.

87,954.—TWINE CUTTER.—S. F. McGowan, New York city.

87,955.—MACHINE FOR MAKING CIGARS.—John McKee and Thomas W. Fletcher, New York city.

87,956.—SAW SET.—John Merrill, Freeport, Me.

87,957.—LAMP BRACKET.—Charles H. Miller, Buffalo, N. Y. Antedated November 25, 1868.

87,958.—DOOR PLATE AND ALARM.—Charles H. Miller, Buffalo, N. Y. Antedated March 2, 1869.

87,959.—LIQUID METER.—John Minor, Peoria, Milton W. Nesmith and George W. Nesmith, Metamora, Ill.

87,960.—SAP SPILE.—Paige Morrison, Starksborough, Vt.

87,961.—MEAT CUTTER.—Gardner Mosman, Boston, Mass. Antedated March 4, 1869.

87,962.—SODA FOUNTAIN.—David Neff, Henry county, Ind.

87,963.—HARVESTER RAKE.—Aaron Palmer and Charles W. Palmer, Brockport, N. Y.

87,964.—MACHINE FOR MAKING CORDAGE.—Isaac E. Palmer, Hackensack, N. J.

87,965.—PREPARATION OF COCOA.—Peter Pearson, Leeds, Great Britain.

87,966.—DUMPING CAR.—Alois Peteler, New Brighton, N. Y.

87,967.—PENCIL SHARPENER.—Charles C. Plaisted, Hartford, Conn.

87,968.—COMPOSITION FOR WELDING IRON AND STEEL.—J. B. Rand, Concord, N. H.

87,969.—STOVE DOOR HANDLE.—William F. Redding, Saratoga Springs, N. Y.

87,970.—DEVICE FOR FEEDING CATTLE DURING TRANSPORTATION.—William Reid, Granton, Scotland.

87,971.—STILL.—George W. Robson, Cincinnati, Ohio, and Melvin T. Hughes, Paris, Ky.

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86,790.—Railroad Car Stove.—Dated February 9, 1869; reissue 3,328.—A. A. Wheelock, Washington, D. C.

83,772.—Elevated Railway.—Dated Nov. 3, 1868; reissue 3,329.—Otto Gsantner, Newark, N. J.

73,807.—Land Mower.—Dated Jan. 28, 1868; reissue 3,030, dated July 14, 1868; reissue 3,330.—A. M. Hills, Hockanum, Conn.

36,017.—Harvester.—Dated July 29, 1862; reissue 3,331.—C. Newhall, Hinsdale, N. H.

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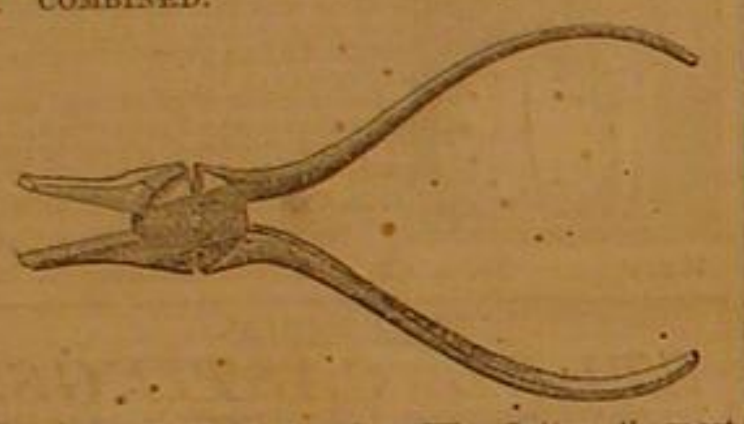

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A GOLD MEDAL

To make it sell; but we have found it necessary to bring suit for infringement, and we hereby give

NOTICE

That last fall we commenced suit against PARKER BROTHERS, of Meriden, Conn., for infringement of our Patent; that, SINCE SAID SUIT WAS COMMENCED, said Parker Brothers have hunted up and purchased an old patent, granted in 1858, for rolling taper blanks. This they have procured to be reissued (Feb. 9, 1869,) in the VAIN HOPE of defeating our rights. Trial will be had in April, when, our Counsel assures us, our patent will be triumphantly sustained. Meantime all parties are hereby cautioned against purchasing or using the Parker Press, having an eccentric disk on the crank shaft for the purpose of adjusting the punch.

N. C. STILES,
Middletown, Conn.
13 2

SCIENTIFIC AMERICAN

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

Vol. XX.—No. 15. [NEW SERIES.] | NEW YORK, APRIL 10, 1869. | $3 per Annum [IN ADVANCE.]

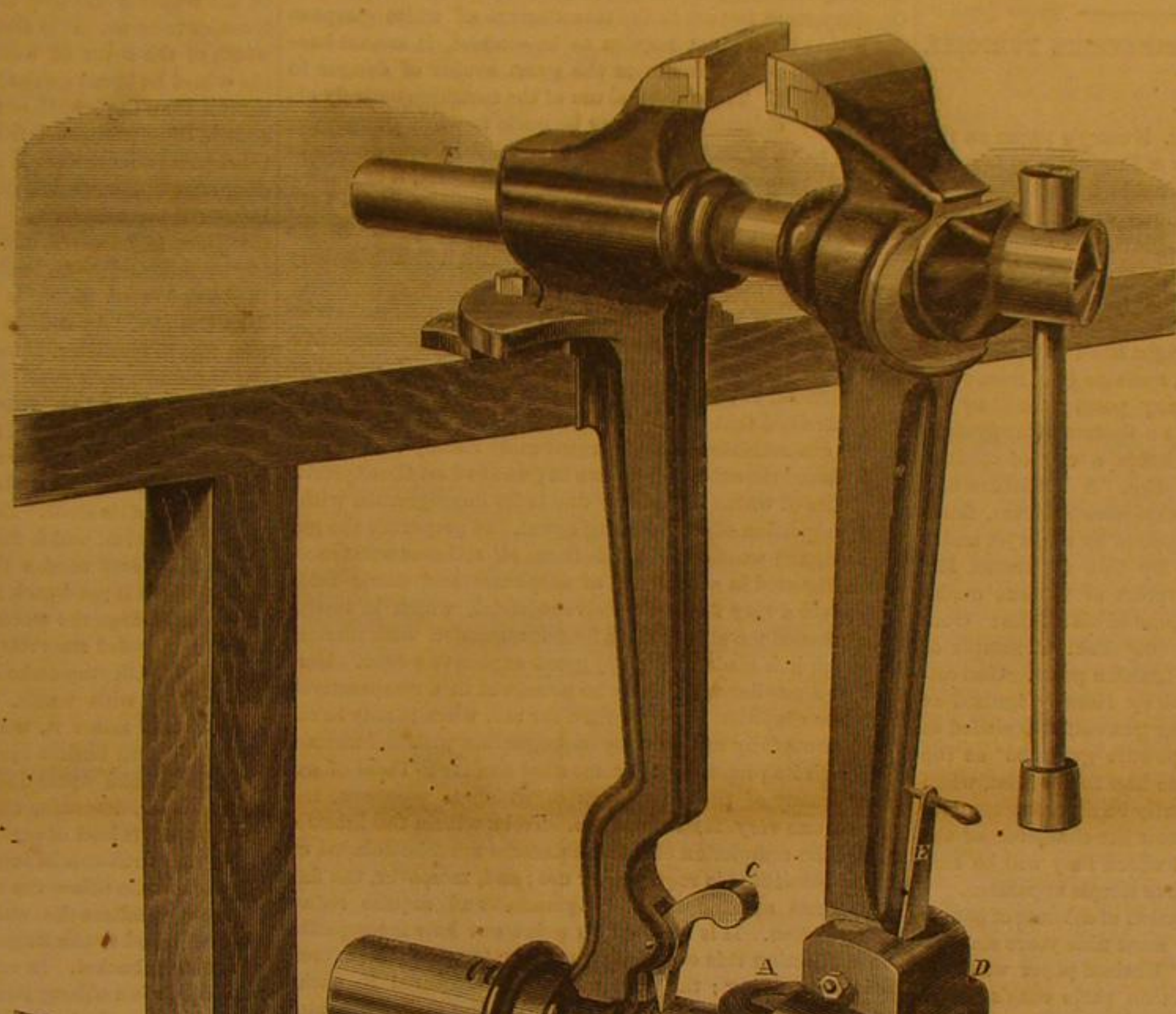
Improved Adjustable-Jaw Vise.

The machinist, the blacksmith, the jeweler, and the workers at some other trades, know the value of a good vise. The vise-man in the machine shop who has a clean, well-ordered bench, a drawer of well-assorted files, gages, straightedges, etc., and above all, a reliable vise, ought to be satisfied with his means of working or—ought to quit the business. Yet, although each variety of vise with which we are acquainted possesses some advantage peculiar to itself, we have never seen one that appears to combine them all so completely as the one herewith represented.

The inventor cites these as the principal objections to the parallel vises now in use: "So constructed that a loss of squeezing power of about twenty per cent is sustained; not adapted to the same hight in all vises, while the rule for the elevation of the top of jaws is the level of the bend of the workman's elbow; the strain, concentrated at one point, increasing the possibility of easy breakage by hard use, having no elasticity, too much rigidity, and considerable wear to screw and nut; having nothing to receive the concussion of a blow; loss of motion, the screw sometimes making an entire revolution or more, before the jaws answer."

It is a leg or post vise, sustained both by the bench and floor, making it solid and firm, by which the full force of the blow is obtained, while it is adjustable in every direction required by the necessities of the work. The foot pivots in a step screwed to the floor, and the rear jaw has a semi-circular ear through which passes a screw bolt, the head of which moves in the segmental slot of a plate screwed to the top of the bench. This permits the whole vise to be swung in a horizontal plane, so as to present the jaws to the edge of the bench at any angle desired, when it may be held firmly by the bolt. The advantage of this is too apparent to the workman to require more than a reference to it.

The front jaw has an offset, A, carrying a ball and socket joint inside the hollow sliding bar, B, that permits the jaw to swing in the usual manner, and also to be turned at an angle to the back or fixed jaw, this latter movement being intended for holding work, the sides of which are not parallel, as a key, etc. To permit this motion, the eye of the front jaw through which the screw sheath passes is made flaring, or trump-shaped, at the front. On the front jaw, encircling the screw, is a saddle washer, the inside of which is made to conform to the outside of the jaw face, so that in whatever position the jaw may be placed, this washer has a perfect bearing.



GARDNER'S PATENT "NEW YORK" VISE.

The sliding bar, B, may be moved in or out by sliding it through the collar in the lower part of the fixed jaw, and is held in position by a pivoted dog, C, the point of which engages with notches cut on the top of the sliding bar. This allows the foot of the movable jaw to be kept parallel with the faces of the jaws, and to be accommodated to the diameter of the work to be held. The spring that throws this jaw out is concealed in the hollow bar, B, and it acts in whatever position the jaw may be. The bar is sustained by a projecting shelf forming a portion of the fixed jaw, strengthened, as seen, by a flange underneath.

When the jaws are parallel they are held in that position by a clutch, D, on the front jaw that slides down and embraces, with its side projections, the squared portion of the sliding bar. When raised to permit the jaw to be set at an angle, it is held by a spring catch, E. The screw is at all times protected from chips, filings, or dirt, by the sheath, F, which is rigidly secured in the back jaw. The offset, A, does away with lost motion, the instant the screw is started the jaws moving simultaneously

The jaws proper are of the best cast steel, reinforced with Swedish iron, and milled to a gage. They are fastened with tapering steel pins and are made interchangeable, so that if they break or wear out they may be replaced at half the cost of annealing, re-cutting, and re-tempering the old style.

It will readily be seen that the strain is equally distributed from the top to the bottom of the vise, and the friction in working is reduced to the minimum. In strength, durability, handiness, and elegance, this vise has certainly no superior. These vises are made of all sizes from eight-inch jaws to jewelers' size. They are made of a combination of Lake Superior, and other ores well known for their toughness, strength, and resistance to percussion. Every vise is put to a test, three times as much as it is intended for in use, before it is sold.

Patented by O. H. Gardner, and made by the Fulton Manufacturing Company, to whom all orders should be addressed at Fulton, N. Y.

ON THE THEORY OF THE LUMINOSITY OF FLAMES.

In 1817, Sir Humphrey Davy published his theory on the causes of the illuminating property of flames. He stated that this phenomenon was due to the presence in the midst of the flame of solid particles which, undergoing partial combustion only, were rendered incandescent. In a candle these were supposed to be solid particles of carbon.

Recent experiments made by Dr. Edward Frankland seem to have entirely overthrown this theory. According to the researches of this eminent chemist many very brilliant flames exist in nature which cannot possibly contain any solid matter whatever.

If, says he, metallic arsenic be burned in oxygen gas it produces a most intense white light. It is, however, well known that metallic arsenic is volatilized at a temperature of 180° C., and that the product of its combustion itself, arsenious acid, is also vaporized at 218° C., while the temperature of incandescence of all solids has been proved to exceed 500° C., so that in this instance no solid particles could possibly exist in the flame.

The vapor of sulphide of carbon burned in oxygen gas or oxygen burned in sulphide of carbon produces a light so intense that the eye can scarcely bear it, and yet we are certain that no solid particles of matter are to be found here. The temperature of ebullition of sulphur, 440° C. is much below that of the flame produced in the above case.

If protoxide of nitrogen be substituted for oxygen in this experiment the result is identical; the light created possessing sufficient intensity for the taking of instantaneous photographs or for producing the phenomena of fluorescence.

Few bodies ignited in oxygen gas emit a more powerful light than phosphorus. The product of this combustion is phosphoric acid, which is gaseous at a red heat, and which could not possibly have contained solid particles at the temperature of a flame which is capable of melting platinum.

The conclusions arrived at by Dr. Frankland are that it is not solid particles which produce luminosity, but that the intensity of a flame depends on the radiation of dense but transparent hydrocarbon or other vapors. As a corollary to this theory he expresses his opinion, based on experimental researches, that a flame becomes luminous at a lower degree of temperature the denser the gases which enter into its composition, and he further infers that this luminosity is to a great extent independent of the nature of the vapor or gas, so that a gas which would burn without producing light at the pressure of the atmosphere, would become luminous, if submitted to a sufficient degree of compression.

In order to prove these facts, Dr. Frankland caused the combustion of jets of hydrogen gas and of carbonic oxide gas to take place in oxygen gas under gradually increasing tensions up to twenty times that of the atmosphere. This he did in very strong iron vessels furnished with thick glass windows which allowed him to witness what occurred in their interior.

Hydrogen gas, when burned in oxygen at the pressure of the atmosphere, gives a very feeble light. Under a pressure of two atmospheres this light is very noticeably increased, and at ten atmospheres a newspaper can be read at a distance of two feet without a reflector. Examined with the spectroscope the spectrum of this flame was bright, perfect, and continuous, from the red to the violet.

The intensity of an electrical spark sent through a gaseous medium is also proportional to the density of the gases, being weak in hydrogen gas, greater in oxygen, and very considerable in chlorine, sulphurous acid gas, etc.

A series of sparks from a powerful induction apparatus passing through air confined in a closed glass tube connected to a force pump, becomes brighter and brighter as the compression of the air is increased, and diminishes gradually in brilliancy as the air is allowed to escape.

The electrical arch, produced by fifty couples of a Grove battery, is much increased when the vapor of mercury is allowed to intervene between the points of carbon of the electric lamp.

The experiments of Frankland have elicited great attention from men of science, and a controversy is at present taking place on the subject at the Academy of Sciences, in Paris, where M. Sainte-Claire Deville affirms that H. Davy's theory is not subverted by the new discoveries, but that the facts observed may be satisfactorily explained if we admit, as he believes to be the case, that the temperature of a flame is increased in the same ratio as the increased pressure or density under which the gas is ignited.

The final verification of this physical law will need further elaborate and dangerous experiments, for the purpose of determining the temperature of combustion of various gases in oxygen, under various conditions of pressure higher than the atmospheric.

These conclusive experiments will soon be begun in France at the Ecole Normale, by order of the Emperor Napoleon III. The operators will be placed within a strong cylindrical iron chamber, where they will be surrounded by air, compressed to at least three times the weight of the atmosphere. Let us here remark that this pressure has been shown by the experiments of the bridge at Kehl to be harmless to the human organization.

The results of these experiments may eventually have a very important practical bearing on the use of gas and of liquid fuels in our furnaces and under our boilers, the heating surfaces of which they may tend to diminish. They may also furnish us with an easy means of working platinum and of producing an indefinite amount of heat, and will probably be the means of suggesting some useful hints for the increase of the illuminating power of our ordinary lighting materials.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. II.

On page 167, we quoted from Mr. Nursey's paper on the above subject, read before the Society of Engineers, of London. The facts therein stated are so valuable for reference, and withal so interesting, that we continue our extracts. Mr. Nursey describes, by the aid of an engraving, a simple apparatus for determining the ignition point of explosives, by which their absolute and relative temperatures are ascertained at the instant of explosion. It is simply a contrivance similar to a portable retort stand. An upright fixed in a weighted base, to stand upon a bench or table, sustains two transverse adjustable sliding bars, secured at any point desired by set screws. From the upper one depends a thermometer graduated to 650° Fah. The lower arm holds a cup of oil into which the bulb of the thermometer dips. A miniature cup containing a small quantity of the explosive mixture, floats on the surface of the oil. Heat is applied by a gas jet under the oil bath, or by a spirit lamp. By this apparatus, Mr. Horsley has ascertained the ignition point of various explosives, and the following are among some of his results: Gunpowder ignites at a temperature of 600° Fah. A sample of Horsley's powder gave 430° as the ignition point. Gun cotton of a powerful character, prepared by Horsley, ignited at 325°, while some of Prentice's sporting gun cotton exploded at 410°. Trials of Schultze's sporting powder gave 385° as the ignition point. It is as well, at a time like the present, when new explosive compounds are constantly being brought under notice, that experimenters should know the character of the material they are dealing with, and which they will be enabled to ascertain by means of the above simple apparatus.

Another, and perhaps safer, application of chlorate of potash to the purpose in question was made some nine years since by M. Hochstädter, a German chemist. Unsized paper was thoroughly soaked in, and coated with a thin paste consisting of chlorate of potash, finely-divided charcoal, a small quantity of sulphide of antimony, and a little starch, gum, or some similar binding material, water being used as the solvent and mixing agent. The paper was rolled up very compactly and dried in that form. In this manner, very firm rolls of an explosive material are obtained, which burns with considerable violence in open air, and the propelling effect of which, in small arms, has occasionally been found greater than that of a corresponding charge of rifle powder. Moreover, the material, if submitted in small portions to violent percussion, exhibits but little tendency to detonation. But, as no reliance can be placed on a sufficient uniformity of action, in a firearm, of these explosive rolls, this alone sufficed to prevent their competing with gunpowder. The same description of explosive preparation, differing only from that of M. Hochstädter in a trifling modification of its composition, was again brought before the public in this country in the early part of 1866, having been patented by M. Reichen. The author has used this gun paper with very good results in rifle shooting, but nothing practical appears to have been done with the material.

The mixture previously referred to as German, or white gunpowder, consists of chlorate of potash, ferrocyanide of potassium, and sugar. Many years since it was proposed and tried without success as a substitute for gunpowder. Since then various preparations of similar character have been suggested for employment, either as blasting and mining agents, or for use in shells, or even for all the purposes to which gunpowder is applied. The most recent of these mixtures with which the author is acquainted, is a white gunpowder made by H. W. Reveley, of Reading. This mixture is a perfectly white impalpable powder resembling flour, powdered chalk, or magnesia in appearance. Reveley recently informed the author that he has constantly made and used it in preference to the ordinary gunpowder, both on account of its superior propelling power—which is at least one-third greater—and its perfect cleanliness. It produces neither smoke nor flash of flame at the muzzle on discharge, and can be used in a casemate with perfect comfort to the gunners. Mr. Reveley has used it for every purpose to which ordinary gunpowder is applicable, and invariably with the most perfect success. He has made many parcels of the white gunpowder during the last ten years, and has always found them uniform, both as regards strength and other properties, and he has never met with the slightest accident, although he has tested it very severely. The composition of white gunpowder is as follows:

Chlorate of potash	48
Yellow prussiate ditto	29
Finest loaf sugar	23
Parts by weight	100

In manufacturing this powder the yellow prussiate is dried in an iron ladle until it is as white as the chlorate. The ingredients are ground separately to very fine powder, and are then mixed by means of a conical sieve until they are thoroughly incorporated, but not by trituration. For small quantities, Reveley uses a common Wedgewood mortar and pestle, which must be perfectly dry and clean. The operation does not take many minutes, and with the above precautions, its manufacture is free from danger. In loading, it is treated in the same way as ordinary gunpowder, being pressed down by hand solid, but not hard. The charge is ignited in the usual way, with a common cap and nipple. In actual use, it does not appear to possess a bursting so much as a propulsive power, and Mr. Reveley has obtained some of the highest penetrative results in his rifle practice with it. The economy of this powder will at once be apparent, when it is stated that its wholesale cost is about 86s. per cwt., but as its strength is at least one-third greater than that of ordinary powder, its cost may be comparatively estimated at about 60s. per cwt. One important feature in the manufacture of white gunpowder is that it does not require to be—indeed, it cannot be—granulated, which process is the great source of danger in powder mills. The universal use of the cartridge entirely obviates any objection that may be made to white gunpowder on that score, or on the score of similarity in appearance to other substances, and, owing to its compact form, it only occupies half the usual space. Beside the foregoing, there have been several cruder applications of chlorate of potash in the production of explosive compounds, which it is unnecessary here to notice more particularly.

Among other materials, wood has been pressed into service to aid in superseding gunpowder as a practical explosive. Soon after Schönbein's discovery of gun cotton, a Prussian artillery officer, Captain Schultze, while investigating the subject, conceived that a finely divided wood could be converted into a controllable explosive agent more readily than cotton. He produced the substance known as gun sawdust, the explosive properties of which are mainly due to its impregnation with a large proportion of an oxidizing agent. In preparing the gun sawdust, the wood is purified from all resinous substances, and is digested in a mixture of sulphuric and nitric acids. This gives a very feeble explosive material, which is further strengthened for ultimate use by impregnation with nitrates, by which it is made to acquire great explosive power. Here, then, is a powder which may be preserved in a comparatively harmless condition until required for use, when it may be rendered powerfully explosive by impregnation with the nitrates. Although its properties are somewhat similar to those of gun cotton, many of the advantages of which it possesses, it is open to one very fatal objection. To be within the limits of safety, the completion of its manufacture must be delayed until the moment it is required for use; and, moreover, the final ingredients are the most dangerous, and require refined manipulation. It is needless to point out how incompatible the conducting this completing process is with the ordinary details of mining; the care and nicety required in such a chemical operation must be referred to the skilled operator, and not trusted to the rough-and-ready hand of the miner. Practical safety can only be attained by an explosive agent into which the stray spark may fall without producing more than a gush of flame, a gradual burning, or without causing ignition at all, but which, nevertheless, when properly rammed home and tamped, may be fired with results at least equal, if not superior to ordinary gunpowder.

Utilization of High Falls of Water.

Glynn's "Power of Water," contains the following in regard to the utilization of high falls of water:

"Attempts have been made to employ a high fall of water by placing one wheel above another; this was tried many years ago at Aberdare, in South Wales, where two wheels, each forty feet in diameter, were so placed, like the figure of 8, and were connected by teeth on their respective rims—the lower wheel receiving the water after it left the upper one, and revolving in the opposite or reverse way. The result was not satisfactory; but in another case, a drawing of which lies before the writer, wherein Messrs. Charles Wood and Brothers, of Macclesfield, had two overshot water wheels, each of twenty-six feet in diameter, and six feet wide, placed over each other, they succeeded in a somewhat different arrangement of the toothed-wheel work. The two wheels were not connected immediately with each other, but by means of *pinions*, which worked into teeth upon the rims of the two water wheels, causing them both to revolve in the *same* direction, so that the water, on leaving the buckets of the upper wheel, was more easily and readily received by the buckets of the lower wheel.

"In either of these cases, however, the employment of the turbine, or the *pressure engine*, would have been much less costly and more effective. The like may be said of all the contrivances to substitute endless chains with buckets applied to high falls instead of water wheels.

"Where the quantity of water is large and variable, and the fall such as may be termed an intermediate hight, but varying also with the supply, it is found advantageous not to lay the water upon the top of the wheel, so that it may work overshot, but to make the diameter of the wheel greater than the mean hight of the fall, and to lay the water, as it were, '*on the shoulder*' of the wheel, or at forty-five degrees from the perpendicular; that is, half way between the horizontal line and the perpendicular, or, as millwrights say, 'at nine o'clock.' Very little mechanical effect is produced in the upper eighth of the circle as compared with the next quarter, on which the descent of the water is nearly perpendicular, and when the wheel is fitted with toothed segments at or near its circumference, acting on a pinion placed on a level with the axle, the weight of the water is brought to bear at once upon the pinion teeth, the stress is taken off the arms of the wheel, and the axle becomes, as it were, merely a pivot on which the wheel turns. By this arrangement, the late Messrs. Hughes and Wren, of Manchester, were enabled to make the arms of their wheels of simple tension rods of bar iron, by which the rim of the wheel was tied and braced to the center, a plan which, with some modifications and improvements, is still in use, and sometimes the segments have interior teeth, which render the wheel-work more compact.

"In the best constructed wheels, the water is laid on in a thin sheet of no greater depth than will give it a somewhat greater velocity than that of the wheel, the difference being just sufficient to pour into the succeeding buckets the proper supply of water. The buckets should be so capacious that they need not be full when the wheel carries its maximum load, in order that no water may be wasted, and that they may retain the water in them till the last moment that its weight on the wheel is effective, and yet empty themselves as soon as it ceases to be so. It is also expedient in practice to make the width of the sheet of water less than that of the wheels; if the wheel be broad on the face, the stream may be four inches shorter than the length of the buckets; the air escaping at the ends is thus prevented from blowing out the water; and all these precautions, though small in themselves, tend to produce smoothness, regularity, and increased effect in the working of the machinery.

"There is, however, one mode of using water power—acting by its gravity—in buckets upon a chain, much employed in South Wales, which is found very useful in raising ore from the pits. An endless chain is passed over a wheel of sixteen feet in diameter, placed between two shafts. The chain passing down each shaft, and through an opening at the bottom between the two, two large buckets, or rather shallow tubs of wrought iron, are fixed upon the chain, so that the suspension is by the center of the tubs, and they are so placed that when one tub is at the top of its shaft, the other is at the bottom of its shaft. Each tub or bucket is covered by a strong platform, which fills and closes the pit's mouth when hoisted up, and carries the small wagon or tram containing the ore upon it; and each is also fitted with a valve at the bottom to discharge the water. A branched pipe, communicating with an elevated reservoir, is laid to the mouths of the shafts, and fitted with stop-cocks or valves. The tub at the surface being filled with water, overbalances the empty tub at the bottom, and raises it, with its tram load of ore, to the top. When the full bucket has descended the shaft, the valve is opened and the water discharged; the other being filled in like manner, descends, and thus alternately each raises the other with its load of oar. The water finds its way out of the mine by a drift or adit into the valley; the long loop or bight of slack chain below the buckets, and hanging to the center of each, equalizes the weight of chain at all times; and a brake applied to the large wheel regulates the speed of the descending bucket. In some places the two buckets work in one shaft of an oblong form; the diameter of the wheel is reduced to seven feet; it is fitted with toothed segments, working into a pinion, fixed upon a second axle, on which the brake wheel is placed, in order to gain the requisite power to control the descending weight. Drawings of both these plans lie before the writer, but the principle and construction are so simple that a description will probably suffice. It may be proper to mention that the buckets generally work in guides, that the discharging valves are opened by striking upon a point or projecting spike at the bottom of the shaft, and that upon the platforms which cover the buckets, there is a portion of the rail or tramway laid to match with the lines of way at the top and bottom of the shaft, so that the tram or carriage may run from the platform to its destination."

Dr. Mallet's Opinion of the Heaton Process.

The following is Dr. Mallet's opinion of the reality and commercial value of Heaton's process:

"This process for converting crude pig iron into wrought iron and into steel, by the employment of nitrate of soda in Heaton's patent converter, has been repeated at Langley Mills many times in my presence. I have examined minutely into its details as applicable in practice on a large scale, and its results; and I have also considered the chemical researches made as to the materials used and products obtained, by Professor Miller, of King's College, and I have been present at experiments, conducted by Mr. David Kirkaldy, at his Testing Works, at Southwark, as to the physical qualities of the products which were obtained by this process, in my own presence, at Langley Mills. In view of all the facts that have come before me, I can affirm the following as truths established beyond question:

"1st. That Heaton's patent process of conversion by means of nitrate of soda, is at all points in perfect accord with metallurgic theory. That it can be conducted upon the great scale with perfect safety, uniformity, and facility, and that it yields products of very high commercial value.

"2d. That in point of manufacturing economy or cost it can compete with advantage against every other known process for the production of wrought iron and steel from pig iron.

"3d. Among its strong points, however, apart from and over and above any mere economy in the cost of production are these: It enables first-class wrought iron and excellent steel to be produced from coarse, low priced brands of crude pig iron, rich in phosphorus and sulphur, from which no other known process, not even Bessemer's, enables steel of commercial value to be produced at all, nor wrought iron, except such as is more or less either "cold short" or "red short." Thus, wrought iron and cast steel of very high qualities have been produced, in my presence, from Cleveland and Northamptonshire pig irons rich in phosphorus and sulphur, and every iron master, I presume, knows that first-class wrought iron has not previously been produced from pig iron of either of these districts, nor marketable steel from them at all.

"Heaton's process presents, therefore, an almost measureless future field in extending the manufacture of high class wrought iron and excellent steel into the great iron districts, as yet precluded from the production of such materials by the inferior nature of their raw products. It admits of the steel manufacture also being extended into districts and countries where fuel is so scarce and dear that it is otherwise impossible.

"I cannot, in this brief communication, point out the prospects which the employment of this system presents, of greatly diminishing the existing waste of material, fuel, time, and wages, in the puddling process, and of lessening difficulties in relation to labor questions which beset that process, injuriously to the British iron trade. Nor can I adequately point out the large reduction in the original outlay for plant which this system admits of as compared with any other for equal annual out-put of iron and steel.

"Dr. Miller has proved, incontrovertibly, that the Heaton process does eliminate from the crude pig iron almost the whole of the phosphorus and sulphur, the trace remaining being unobjectionable in the wrought iron and steel produced, even when they have been made from the pig irons known to be the richest in these injurious constituents of any make in Great Britain.

"The wrought iron made in my presence from Cleveland and Northampton pigs, and tested for tensile resistance, also before me, bore a rupturing strain of twenty-three tuns per square inch, and an elongation of nearly one-fourth of the original unit in length. It is therefore iron of great strength and toughness, and yet probably by no means the very best that this process is capable of producing hereafter. It possesses those qualities which best fit iron for artillery, armor plates, and iron ships or boilers.

"The tilted cast steel, also made in my presence, from the very same pig irons as the above, bore a tensile strain at rupture of above forty-two tuns per square inch with an elongation of one-twelfth of the unit of length. It is, therefore, a remarkably tough and fine quality of steel, well suited for rails, ship-building, and all other structural uses. In a word, steel suited for any purpose known to the arts can be produced by this system from inferior brands of pig iron."

The Electrical Machine at Trinity College.

It is not generally known, says the Hartford *Times*, that Trinity College in this city possesses what, if not the largest, is the most powerful electrical machine in this country. It was made in Vienna expressly for this college. We were present at an exhibition of the same, March 6th, and were as much pleased as we were astonished by the wonderful power of the machine.

It occupies a space on the floor of about 4½ by 5½ feet. The electricity is collected in large brass balls, supported by strong pillars of a peculiar glass, in which there is no metallic substance. The rubbers and the points upon which the axles of the plates work are also supported by the same kind of pillars. These balls are nine inches in diameter, having a smaller ball between them; and from a projecting point midway between the larger balls, the spark is drawn to a metallic surface mounted on glass. This is movable and connected with the rubber and the ground. The large balls are surmounted by two rings of light hollow wood, lined with metal which are thirty inches in diameter, and greatly increase the force of the spark. The whole apparatus, to the top of these rings is eight feet high. The plate is of heavy glass, very clear, 46½ inches in diameter and three-eights of an inch thick. The operator stands at a safe distance, and the handle of the machine is insulated by means of a rod of glass. The rubbers are covered with Bunsen's amalgam and the electricity when generated is taken from the plate by sharp points and conveyed to the above mentioned bath.

It is wonderful what an enormous amount of electricity can be obtained from this machine. A few revolutions of the wheel will cause a spark eight or ten inches long to fly off, and this length can be greatly increased by withdrawing the spark catcher, and pushing in the point from which the discaarge takes place. The peculiar odor which attends the generation of electricity is perceptible in all parts of the room, and persons are affected while standing several feet from the machine. On that evening—and the condition of the room, atmosphere, and other surroundings were not what they should have been for a perfect exhibition of the machine—a spark ten inches long was drawn twenty-one and a-half inches from the machine.

Among the different experiments shown by Professor Brocklesby, that evening, were, first, the charging and discharging of Leyden jars, around the interior of which bits of tin foil, diamond shaped were placed. The electricity would run from one to the other, filling the jar with rows of light. Another jar was lined with gold-leaf, and surrounded by brass filings. The electric fluid would run through this in lightning like streams. Tubes and globes similarly arranged were also shown. Then he showed the effect of electricity passing through vacuum. A hollow cylinder of glass, some five feet in length, was exhausted of air, and connected with the machine, the electricity passing through in streams of a light violet color, resembling the "Northern Lights." Then the effect of electricity on different gases was shown by means of tubes filled with gases. When passing through that filled with nitrogen gas, a yellow light was seen in vertical streams alternately light and dark. In going through carbonic gas, a green light was obtained, while a pale halo seemed to surround the tube. Through hydrogen there was a continuous flow of blue and yellow light, but the prettiest experiment was when the machine was connected with a cylinder filled with a combination of gases. Inside this cylinder was an arrangement of glass coils. As the electric fluid passed through these it gave the appearance of a slender vase of brilliant green, filled with pink, olive, violet, and yellow flowers. Large Leyden jars were then filled, and by means of a discharging rod, the electricity was carried off, passing on its way through a piece of card board on to a chain and wire connecting with the ground. A small hole was pierced through the card. This discharge would be sufficient to knock a man senseless, if not to kill him. Other experiments were tried, shocks administered to those who wished, a jar broken—our reporters hair made to stand on end "like quills upon a fretful porcupine," and an opportunity given to all to see the "long spark." The exhibition was an exceedingly interesting one, and we wish that Professor Brocklesby could be induced to repeat it in a larger hall, where our citizens might have an opportunity of witnessing the workings of the machine.

Solar Heat as a Motive Power.

A short time since we briefly referred to the experiments of M. Mouchot, made with a view to utilize solar heat as motive power. He, in a contribution to the *Comptes Rendus*, thus speaks of some of their results:

According to my experiments, it is easy to collect, at a cheap rate, more than three-fifths of the solar heat arriving at the surface of the globe. The intensity of this calorific source, so feeble in appearance, was revealed by Pouillet, more than thirty years ago. At Paris, a surface of one square meter, normally exposed to the sun's rays, receives, at least, whatever may be the season, during the greater part of a fine day, ten heat units (calories) per minute. [The unit of heat adopted by most physicists is the quantity necessary to raise one pound of water from 0° to 1° C. We suppose M. Mouchot adopts the same standard.] To appreciate such an amount of heat, it is sufficient to observe that it will boil, in ten minutes, one liter of water, taken at the temperature of melting ice, and it is almost equal to the theoretical power of a one-horse steam engine. Under the same conditions, a superficies of one "are" (119·603 square yards) would receive, during ten hours of insolation, as much heat as results from the combustion of 120 kilogrammes (321,507 lbs. troy) of ordinary oil. These numbers are eloquent: they should, if not dispel, at least weaken the serious fears entertained by some, in consequence of the rapid exhaustion of coal mines, and the necessity of going to increasingly greater depths, disputing with the subterranean water this precious combustible. The intensity of the calorific radiation of the sun is, moreover, much less at Paris than in intertropical regions, or upon the elevated plains. It is, therefore, probable, that the invention of "sun-receivers" will, some day, enable industry to establish works in the desert, where the sky remains very clear for a long time, just as the hydraulic engines have enabled them to be established by the side of water courses.

Although I have not been able to operate under very favorable circumstances, since my experiments have only been made with the sun of Alençon, Tours, and Paris, I proved, as far back as 1861, the possibility of maintaining a hot-air engine in motion, with the help of the sun's rays. More lately I have succeeded in boiling, tolerably quickly several liters of water submitted to insolation. In short, having satisfied myself that it was sufficient to have a silver reflector, with a surface of one square meter, to vaporize, in a hundred minutes, one liter of water (0·88 quart), taken at the ordinary temperature, or, in other words, to produce seventeen liters of vapor a minute, I tried to work a small steam engine by solar heat, and my efforts were crowned with success in June, 1866. In the meantime I have been able, by very simple apparatus, to obtain some remarkable effects from insolation, such as the distillation of alcohol, the fusion of sulphur, perfect cooking of meat, bread, etc. None of these experiments, particularly the application of the sun's heat to machinery, have been tried upon a sufficiently large scale. It would, therefore, be useful to repeat them in tropical countries, with "sun-receivers" of suitable dimensions. We would measure the volume and the tension of steam produced in an hour by a given insolated surface, the pressure developed by the sun in a considerable mass of confined air, and the temperature which might be obtained by vast reflectors, formed of a framework of wood covered with plates of silver, etc.

Tea Culture in this Country.

A correspondent of the New York *Times* writing from Knoxville, Tenn., gives some information, additional to that published on page 215, current volume, SCIENTIFIC AMERICAN, in relation to the culture of the tea plant in this country. Writing on this subject the correspondent says, in relation to Capt. Campbell's experiments, that his experience shows that tea can be successfully cultivated in East Tennessee, the climate of which is about the same as that in the tea-bearing regions of China and Japan. Frosts come late in the fall and leave early in the spring, and the winters are short and not severe. The writer says:

The plant can easily be protected, and the experience of Mr. Campbell shows that it can be cultivated here without doubt. His farm is some ten miles southeast of this city, on the rich bottoms of the French Broad River, and well situated for a fair test of culture. The plant is a deep evergreen shrub, and attains, at its full development, a hight of five feet. It is strong and compact, and needs but little protection from the frost. It bears well; it has a beautiful flower which develops about October. The next season produces a seed something resembling a hazel, which grows readily. Mr. Campbell has not attempted its culture to any extent. His idea was to prove fully its adaptedness to this climate rather than to embark in any enterprise in its cultivation. He has for some years raised all the tea he needed for his own family, and he feels quite well satisfied with its taste and the yield. It has been pronounced by several gentlemen fully equal to "Young Hyson." That he should have satisfied himself so long since of the adaptedness of this plant to this climate, and that such conclusions have not long since become known, and the enterprise been fairly tested on a larger scale, is a matter of surprise to me. It is a fact of great importance, as it seems to me, and it might be well for the Agricultural Bureau at Washington to encourage other and more extended experiments. If we can raise our own tea and our own beet-root sugar, we shall be relieved from a heavy expenditure which yearly inures to the benefit of the Chinese and Japanese.

Galvanising Iron--Drawing off the Offensive Vapors.

The application of zinc with tin as a coating for iron, says *Van Nostrand's Engineering Magazine*, has become a most important manufacture in and about Birmingham. The application of iron for every purpose of construction is practically only limited by the difficulty of preserving the surface from rust. No method has yet been adopted which is at once so cheap, so effectual, and so enduring as galvanizing, and the works in which that process is carried on have very rapidly increased. To galvanize iron it is immersed for a certain period in an acid to cleanse the surface, after which it is dipped into a bath containing zinc and tin melted. In this salts of ammonia are thrown, which operate on the metal as a solvent, and enable it to be more evenly distributed over the surface. From this bath is given off a dense, pungent, white-colored vapor, which is heavy, and, especially in damp weather, spreads and becomes offensive. Complaints have been made of these vapors, and various plans have been adopted for the purpose of preventing them from passing into the atmosphere, but heretofore without success. The Wolverhampton Corrugated Iron Company have adopted a plan which is found very effectual. The top of the bath is surrounded by a flue which forms a projecting lip, and from this, run one or more iron pipes communicating with a powerful fan. From the fan a large flue extends to an annealing furnace. The fan, by creating a vacuum in the pipes, causes a strong current of air to pass over the surface of the bath, which drives the vapor into the furnace, where it is entirely consumed. Experiments are in progress to condense the vapors so as to utilize them, instead of consuming them in fires.

Casting Steel Under Pressure by use of Gunpowder.

Casting steel under high pressure by means of gunpowder, is thus described by the inventor: It is well known that cast-steel run into molds is subject to blister, and is otherwise porous, which defect reduces considerably its toughness. In order to give this metal its requisite tenacity it is subsequently reheated and then rolled or hammered. As many articles, such as cannon, cannot be treated in this manner, I have devised to submit them to a high pressure while in a liquid state, inclosed in their same molds, maintained in iron flasks. For this purpose, immediately after running a cannon, I cover hermetically the head by a metallic cap, by means of bolts or other devices attached to the flask. This cap is fitted in its center with a vertical pipe, and provided with a cock at its lower extremity, while its upper extremity is closed by a washer pressed by a bolt in such a manner as to act as a safety valve. Before attaching the cap, at, supposing, one inch from the surface of the liquid metal, I introduce in the vertical pipe, and between the cock and the washer, a charge of about one quarter of an ounce of a powder, prepared in the proportions of eighty parts of saltpeter and twenty parts of charcoal. On opening the cock this powder falls on the metal, ignites and engenders about one-third of a cubic foot of gas at 3,000° Fah. These gases exert on the liquid metal a pressure which is transmitted throughout the entire mass, thereby condensing the same and expelling the blisters. The effect thus produced is equivalent to the pressure of a head of liquid metal ninety feet high, admitting that the capacity between the cap and the surface of the metal contains thirty cubic inches. By making the flasks sufficiently strong, the charges of the powder may be varied, so as to produce by its ignition a uniform and general pressure, which is preferable to the partial, irregular, and momentary action of a hammer.—*Engineering Magazine.*

Louisiana Sugar and Sirup.

An esteemed correspondent of Plaquemine, La., Mr. Evan Skelly, has sent us a barrel of sirup of fine quality, and some samples of sugar, made with his sulphur apparatus, for which he will please accept our thanks. He writes us that "the sirup was made direct from cane juice in common open iron kettles from six degree juice, plant and stubble cane mixed, with the use of three and a-half pounds of sulphur to the hogshead, limed 64 cubic inches to the grand, four grands to the hogshead of 1,000 pounds, made about the 25th November, 1868, (rather late in the season) on the Pecan plantation, in the Parish of Iberville, worked by Mr. David N. Barron, with one of my sulphur apparatus. I send also samples of sugar made with the apparatus on various places, that you may judge for yourself of the practical working thereof. It is well established in New Orleans, that a greater quantity of inferior sugar has been made in Louisiana this year than in any previous year in proportion to the crop, caused from the fact that most of the cane ground was plant, and generally planted in fresh land."

The quality of the samples sent is such as substantiate the efficiency of the apparatus. In the manufacture of neither the sugar nor sirup, he adds, no chemicals were used except sulphurous acid and lime.

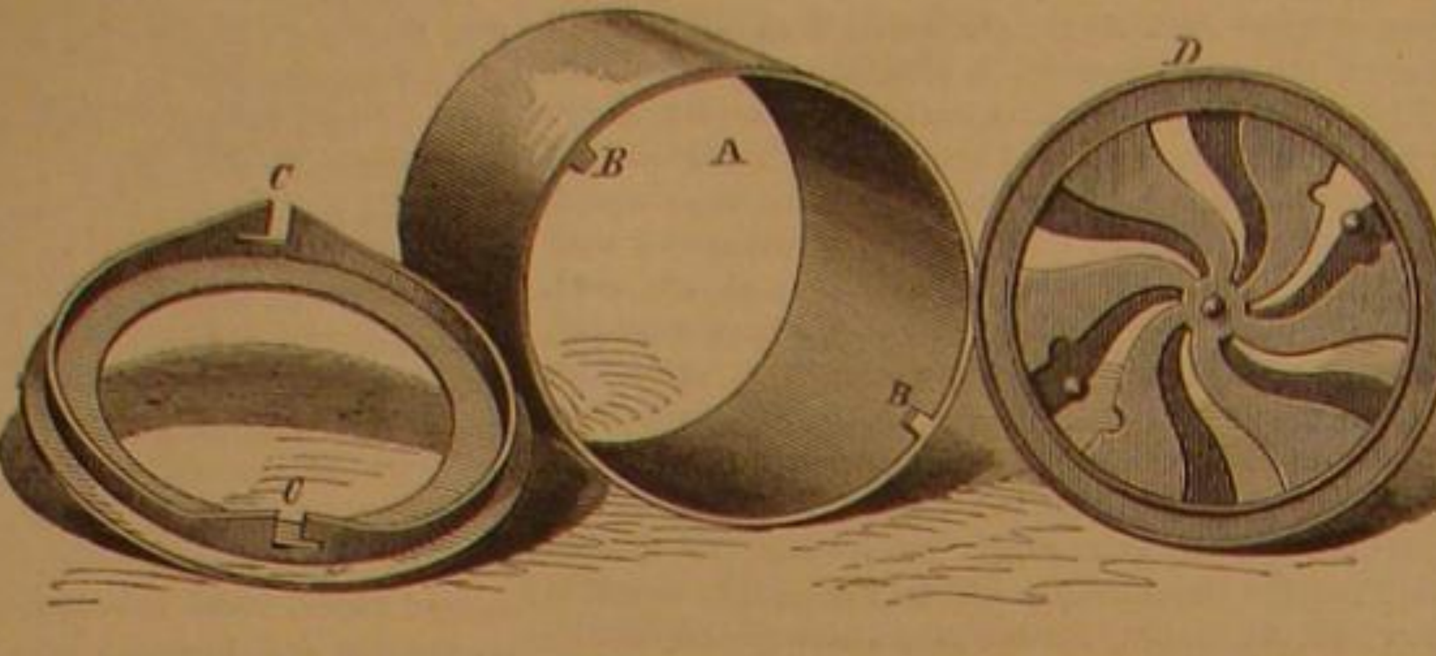
THE sprouts of the potato contain an alkaloid termed by chemists *solanine*, which is very poisonous if taken into the system. This does not exist in the tubers, unless they are exposed to the light and air, which sometimes occurs from the accidental removal of the earth in cultivation.

Improvement in Thimbles and Ventilators for Funnel Flues.

Unsightly tin plates or guards to cover funnel holes of unnecessary size in the chimney are not very pleasant adjuncts to the arrangements of the kitchen, dining, or sitting room. A perfect fit of the stove funnel to the thimble or sleeve makes a neat appearance, whether the thimble is of tile clay, or of sheet or cast iron.

The engraving represents a method of making a neat fit to any size of pipe. A is the thimble or sleeve to be seated in masonry of the chimney. It has snugs, B, which engage with recesses, C, on the flange that is one of a set intended to fit each size of pipe or funnel down to four inches. The register, D, is to take the place of the flange or collar in summer, when the stove and pipe are removed. It is secured in the same way as the collar, by means of a projecting circular flange fitting the interior of the sleeve, A, and the snugs and recesses as seen. This device can be attached or detached instantly, and it makes a neat, safe, and handy contrivance.

Patented, Nov, 3, 1868, by J. L. Little, who may be addressed for rights or for additional information at Atkinson, N. H.



LITTLE'S STOVE FUNNEL CAP AND VENTILATOR.

PROGRESS OF THE VELOCIPEDE.

The interest in the velocipede continues unabated. A "Long Island rider" writes us a description of an improvement which strikes us as being novel at least. It is a device to enable velocipedestrians to use the ordinary horse-car tracks as a way for their machines. The attachment is a bar of iron or rather a rod about ¾ of an inch in diameter with a small wheel at the end, remote from the velocipede proper, and having the other end attached to the "back-bone" of the machine. The small wheel bears on the opposite rail from the one in which the velocipede wheels run, and thus acts as a brace, and prevents running off the track. He says it has been tried with complete success; the machine being propelled with very little effort, and running up a grade with ease and rapidity. These attachments will soon be offered for sale.

The *Journal of the Telegraph* proposes that telegraph messengers be supplied with velocipedes for the more rapid delivery of messages. It says: "The messengers of a company perform a most important part of the telegraphic service. Their service demands a high degree of fidelity, sagacity, determination, beside the mere swiftness of foot necessary to perform their duty acceptably. But there is more practical skill and more persistant watchfulness needed to reduce the time which is even now expended between the reception of a message by the wire and its delivery into the hands of the party addressed, than in all the other parts of its progress. Anything which will reduce the time thus consumed, which will prevent the consumption of an hour or more to deliver a dispatch two miles from a central office which came a thousand miles over the wires in two minutes, must be hailed as an acquisition, and, if possible, made available.

"Well, 'we shall see what we shall see' by-and-by. We would like to see the experiment tried. Ponies were once tried in St. Louis, with what success we do not know. We want to see a good boy straddled across a velocipede and put on his honor and metal. We think there would be some quick time made."

An exhibition of a ladies' velocipede took place at Hanlon's Hall on Tenth St. on the evening of the 24th of March. It differs from the ordinary machine in having the perch lower, and in the arrangement of the spring, making it more convenient to mount and dismount. Instead of a saddle, there is a seat of wicker work neatly woven. The fore wheels are about thirty-two inches in diameter. Two of these machines were exhibited, ridden by two graceful young ladies, who drove the cranks with both feet, in the same manner as men. They were dressed in a very becoming costume of dark woolen stuff, their skirts being divided at the bottom, and buttoning around the ankles, not unlike the trowsers of a Zouave, and exposing the neatest foot and *Chaussure* that can be imagined. Their gloves were of the same hue as their dress; one wore ribbons and facings of blue and the other of pink.

They rode with much skill and elegance as well as strength, and, with the assistance of Mr. Pickering and Mr. Brady, went through with a number of intricate and pleasing figures, in the presence of a large number of ladies and gentlemen, who loudly testified their applause. We have no doubt that this velocipede will come into extensive use among the ladies, who will find it an attractive means of healthful exercise, in halls set apart for the purpose.

A Utica correspondent writes us as follows: "Your velocipedic readers may like to have a ready means of determining their speed. The following method is nearly accurate, not varying from the fact more than two feet two inches in a mile. Divide 336, by the diameter in inches of the driving wheel; the quotient will be the number of revolutions per minute, which will produce a speed of one mile an hour. 336·135245, will give the result more exactly, but 336 is near enough for all practical purposes.

"Thus with a 4-foot wheel, 7 revolutions a minute give a speed of a mile an hour, 70, of ten miles an hour."

A correspondent of Toronto who subscribes himself "Unfortunate" makes some good suggestions He says:

"I have been watching the velocipede notes in your valuable Journal for some time past in the hope of learning that one of these marvelous machines had been invented especially adapted for the infirm and crippled portion of the community, but up to the present time of writing I have discovered nothing suitable. The late war has caused the loss of many a leg and in this age of machinery, the number of maimed persons is increasing. To lighten the lot of this unfortunate class is surely worthy of some thought; many of your ingenious contributors will I am sure, be glad to turn their attention to it, from motives of humanity and not profit. The loss of a leg, replaced by never so shapely an artificial one, incapacitates a man from almost every employment by reason of the difficulty he experiences in moving about. I am aware that there is at present a machine with a crank in the axle used by persons whose pedal extremities have become paralyzed but the effort required for propulsion is very great. I would suggest the construction of a velocipede that could be worked jointly by one foot and one hand or by the hands alone, or the motion might be taken from the shoulder perpendicularly with advantage, the one foot being used for steering. I am not a mechanician and merely throw this out as a hint to any good Samaritan who will take the matter up.

We give herewith an engraving of a two-seated bicycle which will interest our readers. This machine, designed by H. P. Butler, of Cambridge, Mass., seems entirely practicable. The engraving shows the parts so clearly that a detailed description is unnecessary. We may add, however, that the back

seat is intended to be used either as a side saddle for ladies, as shown in the engraving, or an ordinary saddle for gentlemen, both riders assisting in the propulsion. The inventor also has in view the placing of two side saddles over the rear wheel, to accommodate two ladies, who could then assist in propelling the machine.

Several leading firms in Newark, N. J., heretofore engaged exclusively in the manufacture of elegant carriages, have begun the manufacture of velocipedes for New York firms, while other establishments are rapidly turning off the wheels and iron works to supply the trade in other cities.

An inventor in New Albany, Ind., is making a new locomotive apparatus. It consists of a pair of skates on the bicycle order, the wheels being five inches in diameter and three-fourths of an inch wide, fastened to wood, which are to be strapped to the feet. The wheels are made large and broad, in order that the wearer may have no difficulty in passing over rough pavements at a rapid rate.

We understand that the prices are gradually coming down at the halls of instruction, the result of the competition that has arisen. As a counter influence, however, upon the rates demanded, the increasing number of those desiring instruction still enables the proprietors of these places to make large profits

Remarkable Millstone Explosion.

A correspondent from Leesburg, Mississippi, writes us an account of a remarkable explosion which occurred, March 2d, in an adjoining county under somewhat mysterious circumstances.

The millstone was a patent French burr of about 30 inches diameter, considerably worn, having been run for years. The burrs were encased in cast-iron beds and were driven by steam power. The mill had not been in operation more than ten minutes before the fatal accident occurred. The miller was regulating the mill, and finding that it was running too slow, he ordered the engineer to give it more speed; but before the order was complied with, the explosion took place with terrible effect, scattering the fragments of stone in every direction, killing the miller instantly, and wounding five other hands employed about the mill. The report of the explosion was heard at a distance of four miles.

We are requested to give our opinion of the cause of this explosion, which can be accounted for in no other way than either the accidental or malicious introduction of some explosive compound into the grain, which was exploded by the friction of the stones. The loud explosion points clearly to this conclusion, and as it is by no means probable that anything of the kind could have been the result of accident, an effort ought to be made to discover whether or not it was the work of some malicious fiend, in human shape, instigated by motives of revenge, or otherwise.

OBITUARY---LUTHER ATWOOD.

Among the scientific men of this country, and in connection with some of our most important discoveries in the department of natural wealth, the name which heads this article deserves to be perpetuated. The history of the manufacture of coal oils could hardly be written without frequent reference to the labors and inventions of Luther Atwood; and, indeed, in the manipulation of the hydro-carbons, there is no one who has performed such signal service, both to science and the arts, as he

Luther Atwood was born at Bristol, N. H., November 7, 1826, and remained in his native town until 1849. He received only such education as could be gained at the town school and a neighboring academy; but, having evident predilections for the acquirement of knowledge, commenced the study of medicine with Dr. Sawyer, of Bristol, when quite a lad. He, however, soon found that the bent of his desires and capacity was in another direction, and accordingly abandoned medicine for chemistry, to which science he devoted his entire life. He was a natural chemist; and component parts, under his manipulation, seemed to assume their proper correlation, almost by magic. His studies were now prosecuted under great difficulties, and in the face of many obstacles, and in 1849 he removed to Boston to avail himself of the advantages of a wider sphere.

There Mr. Atwood entered upon the manufacture of medicinal chemicals for Messrs. Philbrick & Trafton. The following year he commenced the series of original labors to which his life was to be devoted, by instituting some investigations into the nature of the products of coal tar, as well as the manufacture of benzole and naphtha therefrom. In 1853 Mr. Atwood obtained his first patent, being for a "process of preparing para-naphthaline oil from the distillate of coal tar, collecting the products at certain fixed temperatures;" the product being designated as "coup oil." At about the same time he obtained a patent for the use of manganate of potash for purifying alcohol, the alcohol purified by this process, being known in trade as "Atwood alcohol."

During the following year Mr. Atwood, associated with his brother, William Atwood, now superintendent of the Portland Kerosene Oil Company, and president of the Atwood Lead Company, of the same city, commenced experiments in the manufacture of oil from coal and bituminous products, and these investigations he pursued until his failing health incapacitated him from all mental labor. During the ten years between 1853 and 1864, Mr. Atwood took out no less than thirteen patents, nearly all of which related to distillation, and the manipulation of hydro-carbons. One of his most important discoveries was the process known as "cracking," by which a heavy oil is changed to a lighter grade. Another was the process of distilling coal in a tower, known as the "meerschaum" or "pipe" process. Indeed, the high standard of purity which has been reached by the oils, known under the trade mark of "kerosene," is owing in a very large degree to the original, scientific far-sightedness, and laborious efforts of Luther Atwood. Mr. Atwood was at one time superintendent of the New York Kerosene Oil Company's works at Hunter's Point, and within a few years of his death occupied a similar position in the works at Maysville, Ky. He died of consumption, at Cape Elizabeth, Me., November 5, 1868, after a lingering illness.

A Successful Inventor.—Nothing in the line of our professional duties gives us more pleasure than to hear of the success of inventors, and under this head publish the following from John W Case, of Worthington, Ohio:

From the patent you took out for me one year ago this March, I have realized about $10,000, and all of this I owe to the Scientific American. I have always been of an inventive turn of mind, and have originated a great many things, but have always neglected to patent them, owing to the cost and the necessary neglect of my other business, but on subscribing for your paper, I was induced by reading it to apply for a patent. Therefore I am truly indebted to the Scientific American for my success during the past year.

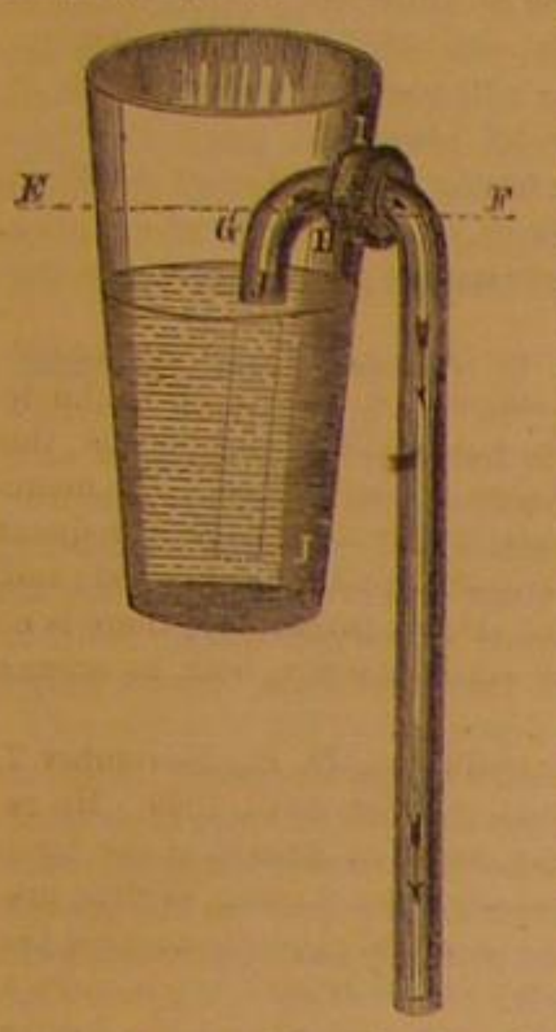
A Prolific Inventor from Texas.—Mr. F. C. Richers, of Gilmer, Upsher county, Texas, arrived at the office of this paper a few days ago, with no less than sixty-two new inventions, on which he is making applications for letters patent. His subjects are quite varied, comprising improvements in nearly every department of mechanical and chemical science, from a steam engine and coffee mill to a process for roofing material, and mode of extracting saccharine juices from cane. All of the inventions exhibit a large degree of ingenuity, and many of them possess very much merit. Mr. Richers will remain in this city several weeks, and parties desirous of engaging in the manufacture or sale of good patented articles, can address him at Box 773 P. O., N. Y.

Correspondence.

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

Intermittent Springs---Silliman All Right.

MESSRS. EDITORS:—Your last number (March 27) contains an article, attempting to demonstrate that the generally received explanation of the working of intermittent springs is either insufficient or absurd. I think it can be shown to be adequate. Without stopping to discuss well-known general principles with regard to the syphon, let us at once take an example to illustrate the case. Suppose the vessel in the accompanying engraving to be an open reservoir receiving a constant supply of water.



For simplicity, let the amount of water received each minute be the quantity which would flow through a two-inch pipe in that time under a pressure of ten feet head. Now let a syphon communicate with the reservoir as in the figure, and let its diameter be two inches or less, and then let us consider what results will follow.

Suppose first the water to be at the level, J, in the reservoir, and the syphon to be empty. As the water rises in the reservoir it will also rise correspondingly in the short leg of the syphon, and when it has reached the level of the bend it will begin to flow out through the tube.

Now, so long as the tube is not full at I it will not act as a syphon. But so long as the tube does not act as a syphon, the velocity of flow at I will be simply that due to the rising water in the reservoir. It is then evident that the water in the reservoir must continue to rise till the velocity of the flow through the tube at I is equal to that due to a head of ten feet, but long before this the tube will be full, and will begin to act as a syphon. It is also evident that a much larger tube would be readily filled at I by the action of the water in the reservoir, since so long as the tube does not act as a syphon, the velocity at I will be very small, and this velocity cannot be much increased till the tube is full.

Our tube now acting as a syphon, let us note what will happen. And first, we will suppose the syphon to be two inches in diameter, and the lower end of it to be ten feet below the point, I. When it begins to act as a syphon, the velocity of flow through it will be just the velocity due to a head of ten feet, and the water will therefore be drawn from the reservoir, at exactly the same rate as it is received by the reservoir, and hence the flow will be continuous. The same effect would evidently be produced if the same sized syphon were any shorter, since the water would rise in the reservoir above the point, I, till the velocity of discharge became equal to the velocity of influx. If, however, the syphon extends to a lower point, say to twenty feet below the point, I, the water will at first flow through the tube with a velocity due to a head of twenty feet, thus discharging from the reservoir much more rapidly than the water is received there, and reducing the level of the water to J, when the flow will cease, to begin again when the water rises to I, thus giving an intermittent syphon. It is easily seen that a tube smaller than two inches diameter would produce the same effect of extending to a sufficiently low level, or a larger tube of even less length than ten feet, the *capacity* of a syphon for emptying a reservoir depending on the comparative level of the water in the reservoir and the lower opening of the syphon, as well as on its size, a fact entirely overlooked by the previous writer.

There are thus many supposable circumstances under which intermittent springs might be produced by the action of a syphon. That these circumstances are not difficult to realize, is shown by the fact that in a hasty experiment made by myself on reading the article mentioned, the second trial adjusted the flow of water from a faucet into the reservoir so as to produce a complete intermitting syphon.

There is also no difficulty in supposing sufficient air to be admitted to a subterranean chamber, if we consider the extremely small quantity which could escape at each break in the flow. The moment that any air is admitted from the reservoir into the tube, the water in the short leg being relieved from pressure instantly flows back into the reservoir and the opening is closed. If the air in the reservoir is now prevented from escaping readily by other channels, it will simply act like the air in the chamber of a hydraulic ram, contracting and expanding with the rise and fall of the water, and sufficient air coming in with the water, or from any minute openings, when the air in the chamber is rarefied, to supply the waste, since, of course, if no air whatever be admitted to the chamber, the flow will finally become constant.

STUDENT.

New Haven, Conn.

[Before replying to our correspondent, we desire to say a word in regard to the practical value of this discussion. In no department of physics are there more points of subtle nicety than in hydraulics. Failure to take into account these nice points is the cause of frequent failures in hydraulic engineering. Many devices have been attempted having for their basis self-acting syphons, and many have been misled on precisely the point in question by the assumption that a syphon will commence to act as a syphon as soon as the fluid in the reservoir rises to the top of the bend, I. The fact is, that no syphon, so large that the flow is uninfluenced by capillarity, will so operate. We can recall many instances where inventors have been misled by the precise words of the text-book from which we quoted in our former article upon the subject, viz.: "*This cavity is gradually filled, until, at last, the water reaches the level, B, B* (see Fig. 1 in the article referred to), *when the syphon is filled, and the water escapes.*" Now, we assert that the water rising in the way described will not have filled the syphon until the level has risen to a point *above* I, a fact shown very clearly in our correspondents' communication.

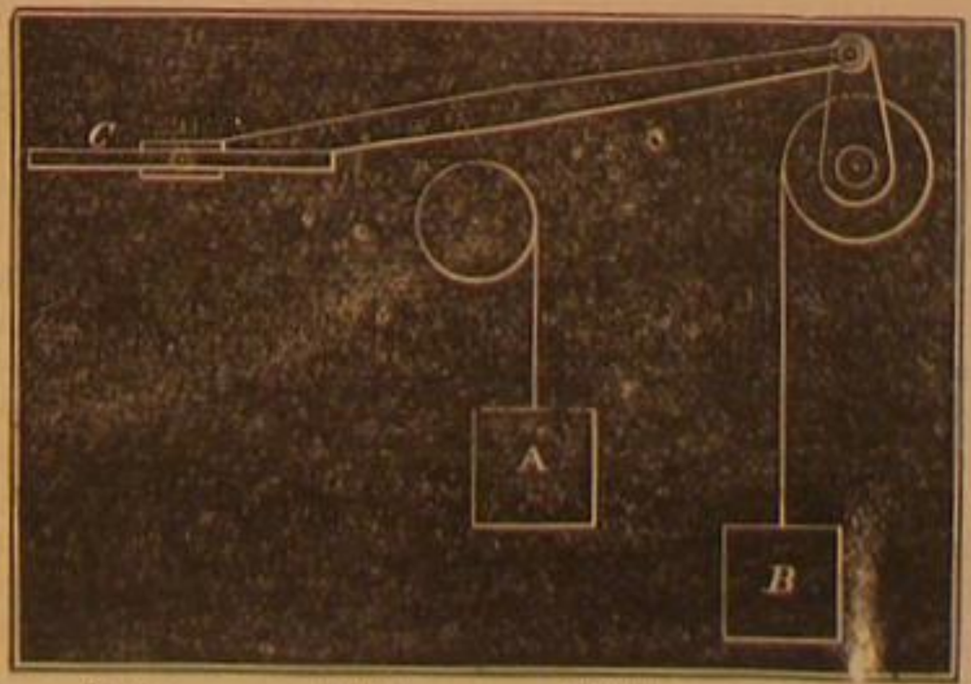
In reply to his statements, we say, first, that we have not claimed that an intermittent fountain cannot be made by the proper adjustment of supply to the capacity of a syphon. A constant supply, operating as he describes, would produce such a fountain, but his description of its action does not coincide with that of the books, as he assumes that the water would rise higher than the level, I, while they say the syphon will be filled when the level is raised to that point, a statement which, as we have shown, is only true of syphons possessing a sufficient amount of capillarity. Had our correspondent, in his experiment—which he states succeeded in the second attempt—observed the position of the level (premising that the syphon used was not a capillary tube), he would have seen that the level previous to its fall by the action of the syphon rose some distance above I, thus confirming his reasoning. This reasoning is not identical with that of the books; but though written to controvert our proposition, exactly confirms it. Instead of overlooking the fact that the capacity of a syphon varies with the relative lengths of the columns in the longer and shorter legs, it was taken fully into account.

Now, if the circumstances of higher level than I, capillarity, and proper adjustment of supply in the reservoir are essential to the theory of intermittent springs, we submit that their omission renders that theory "*insufficient.*" If they are not essential to the theory, and therefore to be disregarded, we reassert that the theory is "*absurd,*" for, in the absence of these conditions, there will be no intermission of flow.

Assuming that they were considered unessential because not alluded to in the books, and because the general proposition that the syphon will be filled, when the level of the fluid in the reservoir reaches I, indicates that they must have been either overlooked or dismissed as unessential, we proceeded to state that the only condition that would make the theory of intermittent springs, as enunciated in the books, tenable, was capillarity. We added some hypotheses which would, in our opinion, account for intermittent springs, only one of which we deemed adequate to account for *all* the facts. It is quite possible we may, upon further reflection, discard that also, but of that more anon. The last part of the communication, pertaining to the inclosed volume of air, is equivalent to the hypothesis of a remittent supply, as the compression and subsequent rarefaction of the air in the chamber, reacting upon the columns of water entering the chamber, would produce a remitting action in their discharge. There are, however, objections to such a view, which those acquainted with the operation of air bulbs upon rams, pumps, etc., will readily discover.—EDS.

The Crank and its Powers.

MESSRS. EDITORS:—I at one time thought, as I see some of your readers still do, that there was a great loss in the crank motion. I tried an experiment as follows: Crank, 6 inches long; connecting rod, 3 feet long; pulley on crank shaft, 7·64 inches in diameter. When the crosshead makes one single stroke 12 inches, the box, B, will be raised 12 inches. The weight in the box, A, represents the pressure on the piston. I divided the stroke into ten equal parts on the guides. The weight in the box, A, was 100, and in the following table you will see what weight it is capable of starting at each tenth. I do not pretend that my experiment is very exact, as my model was rather rough.



Stroke.	Power.	Effects.	
0·1	100	55	
0·2	100	95	
0·3	100	115	
0·4	100	127	
0·5	100	133	(7·64 : 12 :: 100 : 155)
0·6	100	127	
0·7	100	115	
0·8	100	96	
0·9	100	76	
1·0	100	00	
	100	939	

Mean effect, 93·9 per cent

THOMAS PETHERICK, JR.

Easton, Pa.

NORTH CAROLINA makes more money from her peanut crop than from her cotton crop.

Cheap Gas.

MESSRS. EDITORS:—While the people of New York and its vicinity are loudly clamoring against the bad smell, poor quality, and high price of the gas supplied to them by irresponsible monopolies, it is my belief that all these evils will eventually be done away with, through a little sound legislation, and by the application of the co-operative system to the production of this necessity of our present civilization.

It has often been stated, but never proved, that a mode of cheapening gas would be to diminish its cost by saving the whole amount of freight on the coal used in its manufacture, and that this could be done by making it at the mouth of the coal pit and transmitting it, ready prepared, from thence to the centers of consumption.

Having been led accidentally to reflect on this matter, lately, after a conversation with some persons interested in our bituminous coal mines, I, from mere curiosity, have taken the trouble to investigate the practical feasibility or rather non-feasibility of such a project, and herewith forward you a summary of my calculations and deductions, which may, perhaps, interest some of your readers.

The cities of New York, Brooklyn, Jersey, Williamsburgh, Hoboken, and the whole neighborhood, as far as Newark and Elizabeth, consume annually about 500,000 tuns of coal for the production of 5,000,000,000 cubic feet of gas. The freight on this coal amounts to not less than $3,000,000 annually.

If gas could be made at the collieries and conveyed safely from thence to the metropolis in tight, well-laid pipes, the whole of these $3,000,000 would necessarily be economized. Obstacles, however, of a formidable nature stand in the way of such a desirable result, as we shall now attempt to show. Starting from a supposition that the nearest gas-coal colliery is situated at 200 miles, and is 600 feet above our level, and that the gas is admitted into the mains under a pressure of ten inches of water through mains 50 inches in diameter we find, by Hughes' formula, $A=D^2\sqrt{(HD \div LG)}$, in which D = diameter of the main in inches (50 inches); H = the pressure of water in inches (10 inches); L = the length of the main in yards (352,000); G = density of gas (supposed to be 0·42), that $A=2{,}500\sqrt{0{\cdot}0034}=145$, which, multiplied by 1350, Pole's coefficient, gives us 195,750 cubic feet delivered per hour. The pressure here would be 0·36 lb. per square inch of area.

The loss of pressure by passing through mains is, by d'Harcourt's formula, $LQ^2 \div D^5 \times 0{\cdot}611$, in which Q is the quantity of gas passing per hour, L the length of the main in yards, and D the diameter of the same. In our case we find it to be equal to 26,470,399 inches of water, or 13,485 inches per square inch of area of a 50-inch main. This multiplied by 0·036 lbs. the weight of an inch of water, indicates a loss of pressure of 485·38 lbs. per square inch, to which must be added the above 0·36 (or ten inches water), making a total of 485·74 lbs. of pressure needed per square inch of area at the initial point.

As the gas-works are supposed to be situated 600 feet above our level, we have another correction of $\frac{1}{100}$ of an inch of water to make for every foot of descent which adds another 6 lbs. per square inch to the above, and gives a grand total of 491·74 lbs. per square inch, equivalent to a pressure of more than 1,360 feet of water, the realization of which, practically, would amount to an impossibility or very nearly so.

Under such a pressure, could it be effected, no doubt can be entertained that, even with our modern improvements injoining pipes, etc., more than 50 per cent of the whole of the gas would be lost by leakage on the way, so that in reality not more than 95,875 cubic feet per hour would reach the consumers at the end of the 200 miles of mains.

To supply New York and vicinity would require sixteen such 50-inch mains as the above. Iron pipes of good quality, one-half inch thick, would support the pressure, and their weight would be, by the formula, $K=(D^2-d^2)$, in which $K=2{\cdot}45$; D = external diameter of pipe in inches; d = internal diameter in inches; 247·45 lbs. per running foot, or 116,678 tuns for 200 miles. Sixteen such mains would weigh 1,866,848 tuns, and at $45 per tun would cost $84,008,160. Adding to this the cost of transportation, the laying and joining of the mains, the hydraulic appliances, gasometers, etc.; we arrive in round numbers at $100,000,000, which would be needed to carry out a project of lighting New York and vicinity with gas manufactured in the coal regions, at a distance of 200 miles.

We do not believe that the above figures, exhibiting conditions of pressure, leakage, and cost of construction, are of such a nature as will induce capitalists, gas companies, or the public in general, to invest in any wild scheme, which might at any time be brought to their notice, having for its object the removal of the gas works from New York city to the Pennsylvania coal basin. Any such attempt must result in failure even supposing all our calculations to be twice too high.

X. Y. Z.

Laying Out Gear Teeth.

MESSRS. EDITORS.—I inclose for publication, a few words of criticism on an article which appeared in your valuable paper, the SCIENTIFIC AMERICAN, for March 13th.

The article signed "J. C." is upon the subject of gear teeth, and I think it will do harm rather than good unless righted. In the first paragraph he says, "Why are the teeth of wheels made on a curve, is a question which, if propounded to a majority of mechanics, who have almost daily experience on the subject, would not elicit a satisfactory explanation." The The strength of this remark, it appears to me, is no better exemplified than in some of the statements of the very article in question. For example, it is stated that "the curve forming the point (face) of the tooth of one wheel will be a curve for the root (flank) of the other." Also "the curves *thus* formed are the epicycloidal, the proper mathematical curve for the teeth of gearing." If the writer of the article were familiar with such good authority as "Appleton's Dictionary of

Mechanics," the "Practical Draughtsman," and especially with "Willis' Principles of Mechanism," he would probably have said, that when the generating circles are the pitch circles themselves, the teeth of one wheel only could be formed with the epicycloidal curves, and that the teeth of the other must be mere round points; or, if the points of the one wheel be enlarged to cylindrical pins, parallel to the axes of the gears, the teeth of the other must be formed with curves, which are drawn at a distance from the epicycloidal curves throughout, equal to the radius of the pins, as shown in "Appleton's Dictionary of Mechanics," Vol. I, p. 828, and also "Appleton's Encylopedia of Drawing," p. 169, and that the epicycloidal curves *thus* formed are *not* the proper curves for the teeth of gearing as ordinarily properly constructed. Also, if he had said that the circle rolling upon A, generating the curve for the face of each tooth of A, should have half the diameter of B, and *vice versa* for the opposite wheels, and then instead of using the same curves for the flanks, he had recommended radial flanks, as far as the teeth of the other wheel have bearing upon them, he would have approached more nearly to the modern practice of correct mechanics. The method of thus constructing teeth is also illustrated in "Appleton's Dictionary of Mechanics," Vol. I, p. 830, and in the "Practical Draughtsman," and numerous other works.

He further says that "the epicycloidal curve is not invariably given to the teeth of wheels *because* it is peculiar to the diameter of the wheels for which it is constructed, and admits of a limited range in case the teeth are wanted to be used for other diameters than that for which they were made." But it is shown in "Appleton's Dictionary of Mechanics," Vol. 1, p. 825, in "Willis' Principles of Mechanism," p. 107, and in Rankine's Applied Mechanics," p. 444, how a *single circle of fixed diameter* may be rolled on the outside and inside of a pitch circle of any diameter, to generate the epicycloidal and hypocycloidal curves which shall form the outlines or faces and flanks of the teeth for those pitch circles respectively, giving a great number of wheels of various diameters, any two of which will work truly together. A number of wheels of different diameters thus constructed is called a set, or the wheels are said to belong to the same set. Mr. "J. C." gives favor to an old millwright's rule for shaping teeth and cogs, a rule which has been condemned, for failing in accuracy, for twenty-five years or more. This rule, however, is better than none at all, but why use that where we have a so much better approximate method as that presented in Prof. Willis' "Odontograph?"

To those who desire to become experts in the construction of correct gear teeth, I would recommend a careful perusal of the subject, as given in Prof. Willis' immensely valuable work, already referred to, or as found in Appleton's dictionary, also already cited above, in which the subject of gearing, for the most part, represents a recast from Prof. Willis' work.

S. W. Robinson.

University of Michigan, Ann Arbor, Mich.

Messrs. Editors:—Will "J. C." please explain a few lines of his article on "Gearing," page 165? The sentence commences with the words, "Proceeding to form the tooth," etc; "the curve found." What curve? How found? "Opposite direction from point of bisection." What is meant by this? "With the proper radius." What radius is this? How found?

In his figure what is the meaning of the unlettered lines found touching the curve, E *i* and *d d'* ?

In forming the teeth of two wheels of different diameters, is there any definite rule for determining the construction of the curve that forms the outline of the pinion tooth, or is the proper center for this curve determined solely by experience, as this center is sometimes taken at a point not upon the pitch line?

M. N. R.

A Proposition from a Prominent Engine Manufacturer.

Messrs. Editors:—Learning that the American Institute intends to hold a fair during the coming fall, I would make, through your columns, the following proposition, both to the Institute and manufacturers of engines and boilers:

I will contribute $1,000 toward defraying the expenses of a thorough test of steam boilers and engines, to be made under the direction of a committee of experts, to be appointed by the Institute, the test to be made at the next fair. I will send, at my own expense, for competition, one of my trunk engines of 40-horse power, and one of my safety boilers, my competitors also to erect their own engines and boilers of equal capacity.

The test to cover efficiency, economy of fuel, safety, and all other points that make up the practical value of boilers and engines for general use.

John B. Root.

95 and 97 Liberty street, New York.

On Non-Rotary Propulsion.

Messrs. Editors:—On page 165, current volume Scientific American, your correspondent, F. R. P., under heading, "Economy of the Short Stroke of Engines in Non-Rotary Propulsion," takes for granted that, as 75 lbs. pressure (over and above friction) applied at A, could not overcome resistance 10, at the circle B, it would, of necessity, cause resistance 70 at point C, to move to point D. Otherwise it would be obviously impossible, he says, for the engine to make its stroke. (I refer to diagram on page 165, so as to economize space in your valuable paper).

If there was no other alternative but for resistance at B to be overcome and carried to E, or resistance at C to be moved all the way to D, it would follow most assuredly that the power applied at A would be incapable of producing motion. But the power applied at A, instead of moving "all the way" to D may be supposed to move in the direction of D, which is quite another thing. Otherwise (stroke of engine being one foot, power 75 lbs., and resistance at C, being 70 lbs., distance from C to D, 8 feet, as given by your correspondent) we would have, power applied, $1 \times 75 = 75$, and effect produced, $8 \times 70 = 560$, that is, 75 would produce 560, which would be an actual creation of power.

Now, this would be, not only an extraordinary discovery, which would probably soon lead to the further discovery of that great desideratum, perpetual motion, or something akin to it, but it would be a discovery subverting the fundamental laws of mechanics, as well as the late discoveries concerning the correlation and conservation of forces.

Whether there is really any saving of power in the short stroke of engines, I am not prepared to say, but is not certainly *for the reasons* given by your correspondent.

R. Desbonne.

St. Louis, Mo.

Results from Expanding Steam—The Indicator.

Messrs. Editors:—In your issue of March 17th there is a communication under the title of "Wonderful Results from Expanding Steam," criticising an indicator diagram, published in a certain pamphlet, which is so obviously the one circulated by the Wood & Mann Steam Engine Company, that a few words from us on the subject, perhaps, may not be inappropriate. That the card published in that circular is a literal and reasonable one, no engineer would doubt; that it is a good one—far above the average—no engineer competent to apply the test of the theoretical diagram can deny; but the increasing interest shown by manufacturers in the use of the indicator, and the importance of having its functions rightly understood, induce us to ask the favor of a little space to continue the discussion.

Let us state, in passing, that the card published in the Scientific American, is not exactly a reduced copy of the one in the circular; the characteristics which are enlarged upon in the article seem to be exaggerated in the engraving. Your correspondent is evidently familiar with the law governing the expansion of gases and the "Joule's equivalent;" that his experience is very limited in the practical working of those laws, as shown by the indicator is also evident, or he would not take upon himself to say "that such a card was never fairly taken from any steam engine." They who adopt the slashing style of criticism ought to thoroughly understand their subject.

The high terminal pressure to which he objects is, in ordinary working engines, the rule and not the exception. Only in first-class cut-off engines, and in those not always, does the line traced by the pencil of the indicator show a curve nearly approaching the theoretical. A Corliss engine, driving the Utica Cotton Mill, has been in constant use for seven years, during which time the valves have never been repaired. We have recently taken a card from this engine, which shows the actual expansion curve to be within three per cent of the theoretical.

If your correspondent will be at the pains to apply an indicator to any engine, except a Corliss, running in his immediate neighborhood, and subject the cards to his analysis, he will doubtless be surprised to find their terminal pressures show a still greater disregard of the law governing the "expansion of gases" than the one in the Wood & Mann circular. It will be proper here to state that the card referred to was taken some time ago from an engine, in which certain patent balanced valves were used, but their lack of tightness and excessive steam clearance was found to more than offset the advantage of balance. The one we now use is the slide valve, with the Corliss valve gear.

Your correspondent's method of judging the comparative performance of different engines by bringing them to a common standard is, doubtless, the correct one; but he errs in supposing the amount of steam used is measured by that admitted to the cylinder up to the point of cut-off—it is not the amount admitted, but the amount exhausted; it is the volume of steam in the cylinder at the opening of the exhaust valve which determines the quantity of heat required to do the work of the half-stroke of that engine. The item of "units of heat," lost in developing power may be disregarded, or rather only regarded generally along with other losses of which the indicator takes no note, such as leakage of piston and exhaust valve, condensation, the re-evaporation toward termination of stroke (which latter, especially in a slow-running condensing engine, goes far to produce the result in the expansion line, so startling to your correspondent), goes further than any cause perhaps, except leakage of steam valve, to which the editor alludes. The clearance in this engine, of which you also speak, is large, being four per cent of stroke. This affects the expansion line, but with proper management of exhaust valve and "compression curve," is not a fault. Your correspondent also alludes to the increasing pressure, which begins at one and one-half inches from termination of stroke, and reaches forty pounds at the end; this he evidently believes is due to lead on steam valve. It is, on the contrary, due to early closing of exhaust valve. The card as drawn in the Scientific American, really shows *a negative steam lead*, the steam valve not opening until the piston has moved some little distance on its forward stroke.

That the indicator shows with absolute accuracy the power and working condition of an engine, no intelligent engineer will claim, but in experienced and judicious hands its value is unquestionable, especially in testing the relative performance of various engines. We have found a simple and effective method of bringing engines to a standard, and testing them by their cards, to be the Regnault tables.

Howard Rogers.

Utica, N. Y.

Peat.

Messrs. Editors:—You are probably well advised of the great number of improvements that have, within about four years past, been patented, for treating peat for heating purposes, yet may not be as well informed as to the number of individuals and associations, who during that period have ventured their money and lost in trial to utilize this immeasurably extensive and highly valued product of nature, which is consequently much abused; while the entire fault lies with the too-confiding promoters for trusting to impractical theories, when a little investigation and a few almost inexpensive tests would have proved the fallacy of the system proposed.

As the season is nearly upon us when peat deposits can be worked, and as many parties will doubtless engage in the work, I am confident that you will gratify your army of readers by giving them a few useful hints and practical advice upon this important question for the manufacturing and home interests, as well as to the owners of peat lands, which information will come most legitimately from the Scientific American.

Wherever soil is exposed to constant water saturation, from springs, or by percolation, or intermittent overflow from a stream, pond, or lake, or from any two or more of such causes, the vegetation of such soil will be converted into peat; and all fibrous vegetable matters, whether grasses, mosses, leaves, twigs, plants, shrubs, roots, and even trees, in fact all woody matter which may become enveloped therein, will, in process of time be converted into that dark brown pulpy substance.

Surface depressions, particularly where underlaid by water leaving clays or rocks—even upon the sides and tops of elevated lands—and most meadow lands holding or overflowed by water without intermittent drying, accumulate peat by the annual decomposition of the vegetation growing on the spot, or which may become immersed within it.

Some deposits of grass and moss peat predominate in fiber throughout, and often for a few feet only from the surface. This description is inferior to the pulped or decomposed vegetation. It is manipulated with difficulty and almost impossible to condense from its extreme sponginess and the elasticity of fiber. Except in very rare cases, and then at very considerable depth, all peats are spongy and retain their porosity after being dried, whatever may be the means used therefor, in which condition it has little commercial value as fuel; hence the necessity to condense it, which in fact is imperative, and to do this some mechanical means must be used to knead and break up the cellular structure.

A bed of peat is often more or less impaired by earth washings, particularly around its borders. This is caused by the water shed from adjoining elevated lands, or by freshet overflows from a bordering or bordered stream. Such adulterations may permeate those carboniferous accumulations of ages, from first to last, and consequently impoverish the peat throughout. Such cases, however, are seldom. Sedimentary washings rarely extend beyond a few feet from the escapement of the ground furnishing them.

This earthy matter is the chief cause of difference in the heating values of peat, and it will always be found admixed with the ashes, causing this residue to vary from two to fifty per cent of the original weight, beyond which it is difficult of combustion. Of course the less ash the better peat.

The color of peat when dry is no indication of its quality, whether it be light or dark brown, or even jet black.

Pine, fir, cedar, juniper, and cypress, furnish peat of more combustible nature than less resinous plants. Its commercial or heating value therefore differs considerably according to the nature of the original vegetation.

Peat consequently being the product of vegetable fiber or woody matter, decomposed and concentrated by chemical disintegration without the loss of an atom of the calorific power, it follows that in a condensed state it should have great heating properties.

The first step to be taken is to determine the quality of your peat. To do this, take a few pounds of peat from any convenient depth, and at proper distances from the border to escape the earth washings, if in such a locality, and where the peat is as free as possible from fiber. Dry the peat thoroughly in the air; then pulverize a portion, from which carefully weigh an ounce, say 480 grains, which place on a hot fire—coals are best—in a shallow vessel, covering the vessel loosely to exclude the air. A drip saucer to a common three-inch earthen flower-pot is a good vessel for the purpose.

As most air-dried unmanipulated peat contains about one-fourth its weight in moisture, this will pass off around the edges of the cover as vapor, and be succeeded by gas, which, ignited with a flame, yields a bluish, reddish, or bright flame, according to the character of the peat, the gas being hydrogen and carbon combined in different proportions. When the gas has ceased flowing remove the vessel with the cover still on and allow it to cool, after which weigh the charcoal with care—at the druggist's or doctor's if you have not the means to do so—being careful to note the weight in grains.

Having noted the time that the gas continued to burn, and as near as you can the color, write that down also, and next replace the charcoal on the fire but without the cover. The charcoal spread evenly over the vessel will soon ignite, and by absorbing oxygen from the air decompose and leave the ashes. This process may be slow but it must be thorough, requiring the mass to be occasionally stirred with some non-combustible article until all the sparks of coal have disappeared. Then remove carefully without losing any of the ashes and when cool weigh again. If the ash does not exceed twenty per cent of the weight you can proceed with further investigations, as the heating properties lie first in the gas, and secondly in the charcoal; the combustion of these two mediums determines the measure of calorific power. The weight of peat consumed being known by deducting the ashes and allowing for the moisture, gives directly that destroyed by combustion as the index of value.

For your next number I propose to furnish another paper upon harvesting and manipulating peat for heating use.

J. B. HYDE.

119 Broadway, New York.

Lamp Flames.

MESSRS. EDITORS:—If a lantern with a flat wick—the one noticed had the ordinary kerosene burner without chimney—is suspended by a cord and then rotated, the flame will assume a twisted shape like an auger, but strange to say the twist will go ahead of the wick instead of behind it; that is, if the lantern, as seen from above, rotates to the right, the twist of the flame will be left handed, instead of right as we would naturally suppose it should be considering the resistance of the air. Can your readers explain the cause?

R. F. H.

New York city.

Estimated Horse-power of Engines.

A correspondent, "Mathematician," of March 27, page 197, deprives the steam engine of its due, by deducting from its usually estimated power, what is required to propel the unprofitable part of its work, viz., the engine and gearing, before arriving at the work desired to be done.

The engine is entitled to credit for all the labor performed, useful or *useless*. "Mathematician" gives, as explaining his views, an engine of 30-horse power, making 75 revolutions when doing the intended work, but, when this work is detached, will make double the number of revolutions, "with the same amount and pressure of steam." Thence coming to the conclusion that twice the power, by the usual estimate, is developed, making the engine a 60-horse power when running empty, and a 30-horse when loaded, "which is absurd."

In the above example, the useful and *useless* work are considered equal, and the engine would, therefore, drive the *useless* alone, through double the space, and, of necessity, for the same amount of steam, under an expanded steam pressure of one-half the pressure on the combined work, which accords with the usual estimate, and *is rational*.

Pittsburgh, Pa. T. W. B.

The Kindling-Wood Business---How it is Conducted.

There are at present in this city and Brooklyn about sixty wood-yards, where the business of sawing and splitting wood is carried on, and which furnish the inhabitants of the two cities with their kindling wood.

The largest quantity of the pine wood received here is furnished by the State of Virginia, particularly that portion of the State which is watered by the James and York Rivers. Delaware and Maryland send a large quota, but they are not so prolific in the production of pine as the first-named State.

The State of Georgia grows a great deal of pine wood, but it is not in as great demand, nor does it command the ready sale that the wood does that is raised in the States of Virginia and Maryland, as it contains too much pitch, which, when the wood is used for fuel, causes a very thick black smoke to arise from it, which blackens the housewife's culinary utensils, and clogs up the flues of the stove. Hence, for burning purposes, "Old Virginia" pine has the preference.

In some instances large dealers and speculators buy up large tracts of land covered with pine forests, and, after cutting it down, the wood is placed on board of schooners and brought to this city, where the consignees dispose of it to the smaller dealers. The heaviest shipments are made in the fall of the year, at which time it is no uncommon thing to see a fleet of fifty or sixty schooners laden with pine, anchored off the Jersey Flats, the headquarters for them on their arrival at this port.

A great deal of the wood, on its arrival at the yards, is cut up into kindling size, ranging from two and a half to eight and nine inches in length. The wood which is cut into pieces from two and a half to four inches in length, is tied up into small bundles, which are sold to the retail grocery dealers. The longer pieces are sold by the box, twelve of which boxes, when honestly filled, hold an ordinary load of wood.

There are some dealers who buy the wood already split at the yard, and peddle it about the city in their own wagons. Many of them have become so expert at the packing process that they manage to make half a load of split wood fill up twelve boxes, so as to deceive any one who does not take the trouble to examine the contents and to see how the wood is packed. These unprincipled dealers do not hesitate, when filling their boxes, to so arrange the sticks at the bottom that they form a kind of network, after which they fill up the box; and to those who are not up to the dodge they present the appearance of well-filled boxes, standing any amount of "shaking down." It therefore behooves those who buy their wood by the box from the peddlers, to stand by and see that the packages are honestly made up, otherwise they run the risk of being grossly swindled.

There are three ordinary loads in a cord of wood, and when wood is bought at the yard by the cord, as a great deal of it is, it is cut into as many lengths as desired, at a charge of $1·50 a cord, the number of lengths making no difference, as it is sawed by steam power; whereas the charge when sawed by hand, using a bucksaw, is $1·50 a load.

Boys from ten to fifteen years of age are employed at the yards to tie up the wood into bundles, for which they are paid twenty-five cents per 100 bundles. A smart boy can tie up on an average 600 a day, which enables him to make very fair wages.

A small machine is used which answers the double purpose of gaging the size of, and tightening the bundle. The machine consists of a rod of curved iron about a quarter of an inch in diameter, which extends above the bench, into which the pieces of wood are placed, and when this is filled, the boy places his foot on a lever below the bench, which is attached to the hoops encircling the wood, and by bearing his weight on it, causes the hoop to press the wood closely together.

There are about 800 bundles in a cord, and the present price per bundle, four cents when bought singly, foots up the snug little sum of $32 per cord. When bought at the yard by the cord the price ranges from $14 to $16. Poor people who are forced to buy their wood by the bundle are compelled to pay twice as much for it as the wealthy.

There is very little hard wood used for fuel, lighter wood being preferable, as it burns more readily. The hard wood is used principally for making mallets, wedges, etc.

Spring Diseases.

Reader! have you a mite, one solitary atom, of common sense? If you have, be persuaded to make a healthful use of it and commence on the instant. As soon as spring begins to set in, almost everybody has more or less a feeling of lassitude; there is less buoyancy, less of an appetite, less disposition to exercise; some are so indisposed that they have to keep in the house, and numbers take to their beds. All this is your own fault; it's because you have got no sense, not a particle; or, if you have, you do not make use of it. You can readily understand that now, as the weather is warmer, you do not require as much fire in the house; and may be you are wondering why the servants will persist in making the house hotter now than in the depth of winter; they are only burning as much fuel now as in mid-winter, and they have not the sense to know this, or at least they do not care to think. The human body is a house to be kept warm; and, to be in health, its heat must be maintained at the same temperature the year round—that is, about ninety-six degrees. The stomach is, in a sense, the furnace; the food put into it the fuel; the lungs set it on fire. Why, then, do you eat in warm weather as much as in cold weather? On a spring day, when scarcely any fire is needed in the house, you cram as much fuel into your stomach as in the depth of winter. You see now that you have not as much sense as Biddy; she is only trying to burn up your house, you are trying to burn yourself up with fever. A baby not three months old has too much sense to poke into its little finger into the candle twice, yet you are poking your whole gluttonous hulk, head foremost, every day into the furnace, and yet actually don't know what hurts you. You don't think; or, if you do, they are such diluted, milk-and-water "thinks," that a dime a load would be a bad bargain to the purchaser.

In adult life all the food we eat serves two purposes; it sustains and keeps warm. For the latter object meats, oils, butters, gravies, and sweets are used; hence, in warm weather, a comparatively small amount of these things should be eaten; but in their place take breads, fruits, vegetables, melons, and berries. Nature's instincts call loudly for the acids of berries and fruits, and for the earliest tender vegetables, the "greens" and the salads of our gardeners. It is because they have no heating qualities; they are rather "cooling" in their nature. They who spend much of their time indoors, would enjoy an exemption from a great many bodily discomforts if, upon the first day of spring, they would begin to have meat for only one meal in the day, and in lessening quantities as the summer comes on.

[The above from our excellent cotemporary, *Hall's Journal of Health*, we indorse as, in the main, timely advice. But would it not be better, Doctor, to qualify the advice, and recommend a reduction of animal food in accordance with the consumer's occupation. A man at the "anvil" certainly requires more hearty food than the merchant or professional man. And in recommending fruits and berries, we know many persons on whom the acid of these articles acts injuriously. Admitting this, would it not be well to recommend persons to watch the effect of fruits and berries upon their systems, and if flatulency exists after partaking, had they not better substitute oat meal or other light food which the stomach does not repel?—EDS.

Shiftlessness of an Artist---What Came of it.

An artist in *Harper's Monthly*, says: "In the spring of 1841 I was searching for a studio in which to set up my easel. My 'house-hunting' ended at the New York University, where I found what I wanted in one of the turrets of that stately edifice. When I had fixed my choice the janitor, who accompanied me in my examination of the rooms, threw open a door on the opposite side of the hall and invited me to enter. I found myself in what was evidently an artist's studio, but every object in it bore indubitable signs of unthrift and neglect. The statuettes, busts, and models of various kinds were covered with dust and cobwebs; dusty canvases were faced to the wall, and stumps of brushes and scraps of paper littered the floor. The only signs of industry consisted of a few masterly crayon drawings and little luscious studies of color pinned to the wall.

"'You will have an artist for your neighbor,' said the janitor, 'though he is not here much of late; he seems to be getting rather shiftless, he is wasting his time over some silly invention, a machine by which he expects to send messages from one place to another. He is a very good painter, and might do well if he would only stick to his business; but, Lord!' he added, with a sneer of contempt, 'the idea of telling by a little streak of lightning what a body is saying at the other end of it! His friends think he is crazy on the subject, and are trying to dissuade him from it, but he persists in it until he is almost ruined.'

"Judge of my astonishment when he informed me that the 'shiftless' individual, whose foolish waste of time so excited his commiseration, was none other than the President of the National Academy of Design—the most exalted position, in my youthful artistic fancy, it was possible for mortal to attain—S. F. B. Morse, since much better known as the inventor of the electric telegraph. But a little while after this his fame was flashing through the world, and the unbelievers who voted him insane were forced to confess that there was at least, 'method in his madness.'"

The "Wave" Time of the Electric Telegraph.

We have already published a full account of the interesting experiment of transmitting telegraphic signals to San Francisco and back; but the Boston *Traveler* adds the following official figures from the records at Harvard College: "It was proposed to begin with a comparatively short loop, extending from Cambridge to Buffalo and back, and then to extend the loops successively to Chicago, Omaha, Salt Lake, Virginia City, and finally to San Francisco. The plan was put into execution on the nights of February 28 and March 7, and in both instances the results were extremely successful. It was quite fascinating to stand before two instruments, a few inches apart, and to see and hear a signal made upon one repeated on the other in a fraction of a second, after having traversed a distance of over seven thousand miles.

"Below is given a table which shows the time, to hundredths of seconds, occupied by a signal passing from Cambridge to each of the stations and back. The numbers of repeaters in the circuits are also given:

"TIME OF TRANSMISSION FROM CAMBRIDGE.

	Seconds.	
To Buffalo and return	0·10	1 repeater.
To Chicago and return	0·20	3 "
To Omaha and return	0·33	5 "
To Salt Lake and return	0.54	9 "
To Virginia City and return	0·70	11 "
To San Francisco and return	0·74	13 "

"The actual time of transmission, from Cambridge to San Francisco and back, does not probably exceed three-tenths of a second; the 'armature times' of the thirteen repeaters in all probability amounting to four or five-tenths of a second."

Paint for the Protection of Metals from the Action of Sea Water.

A paint for the protection of iron and other metals from the detrimental influence of sea water, and the prevention of "fouling," has been invented, and is made in England as follows:

30 parts of quicksilver.
7 " thick turpentine.
55 " red lead.

These materials are mixed with as much boiled linseed oil as is necessary to make a paint of the proper consistency. The quicksilver must be thoroughly amalgamated with the thick turpentine by grinding or rubbing, and this mixture must be ground with the red lead and more boiled oil. A little oil as is necessary to make the paint "lay" well must be used. In damp weather, some fine ground manganese may be added. To make this paint adhere more firmly, a previous coat of oxide of iron paint may be applied. The use of the quicksilver, turpentine, and red lead are the special features claimed by the inventors.

AMMONIA AS A REMEDY FOR SNAKE BITES.—In the last volume of *Transactions of the Royal Society of Victoria*, published at Melbourne, there was an account of Dr. Halford's interesting researches into the nature of the change produced in the blood by the poison of snake bites. The doctor worked with the microscope, satisfied himself that there was a change, and described it, and has since had an opportunity of testing his theory and his antidote. A man working on a railway was bitten by a snake: ere long, drowsiness came on; medical assistance was obtained, but by the time it arrived, the man was comatose, and his lower extremities were paralyzed. Dr. Halford was then summoned by telegraph: he made an incision in a vein, inserted the point of a syringe, injected ammonia diluted with water; and the effect produced is described as "marvelous and immediate." The man became conscious, steadily recovered, and became quite well. Henceforth, let all people who live in districts infested by poisonous snakes, remember that ammonia injected into a vein is the remedy for a bite.

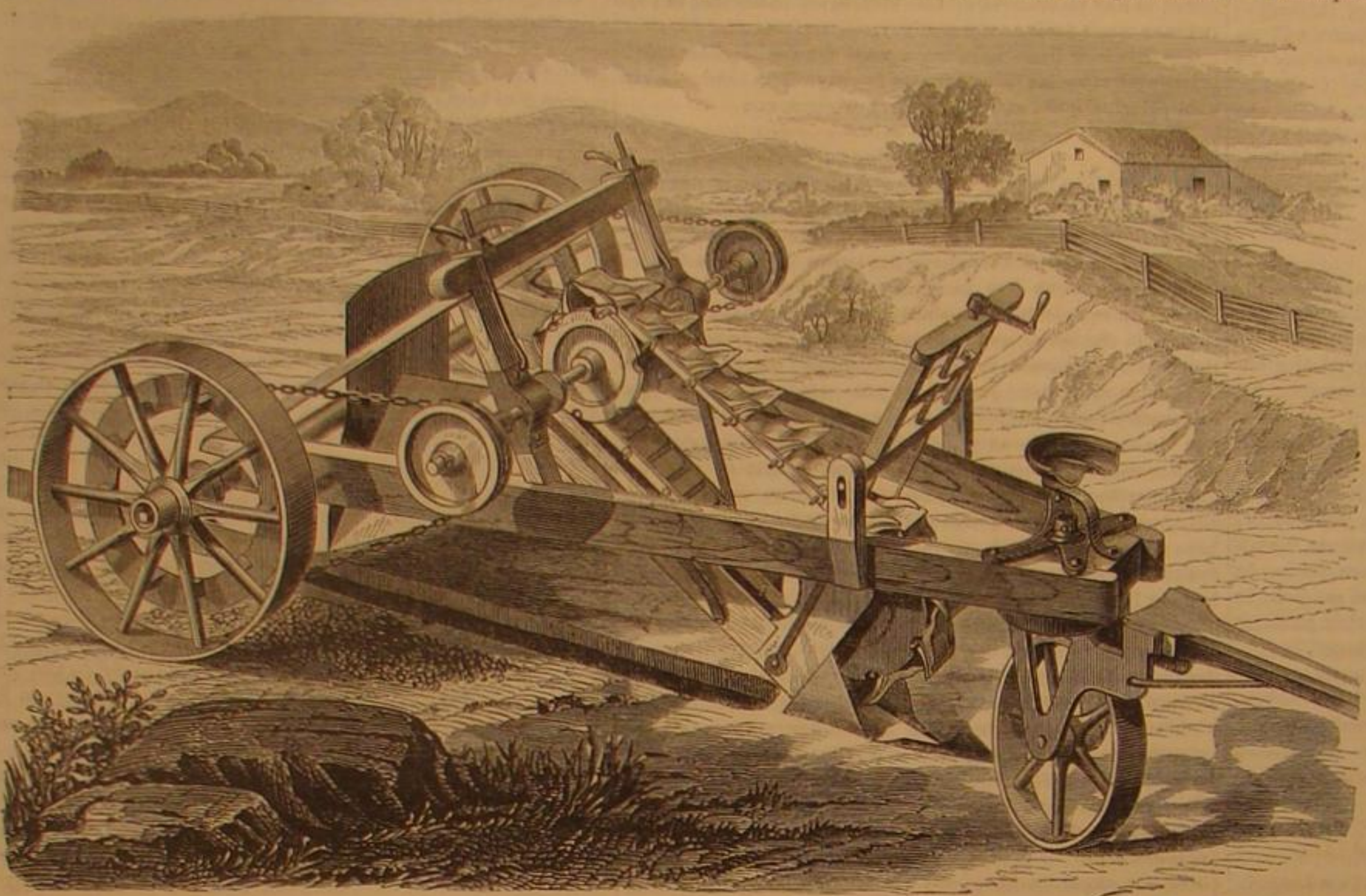
STRAW HOUSES.—An English inventor has built some houses on a novel principle at New Hampton. The houses are of a cheap order designed for laborers. He compresses straw into slabs, soaks them in a solution of flint, to render them fireproof, coats the two sides with a kind of cement or concrete; and of these slabs the cottages are built. By ingenious contrivances, the quantity of joiners' work is much reduced, and the chimney is so constructed as to secure warmth with the smallest consumption of fuel, and at the same time to heat a drying closet. The cost of a single cottage of this description, combining "all the requirements of health, decency, and comfort," is eighty-five pounds. The commissioners on the employment of children, young persons, and women in agriculture, report favorably of these cottages.

THE directors of the New York and New Haven Railroad have decided, as an experiment, to use wooden wheels on some of the cars upon their road. Quite a number of these wheels have been purchased, and will be substituted for the present iron ones on some of the new cars. They are understood to cost nearly treble the price of iron wheels, but are considered quite as cheap in the end. They are made of elm or teak wood, and bound with steel tires. Besides being less liable to break by the action of frost, they make less noise.

Improved Machinery for Excavating Ditches.

Draining the soil is an important process in agricultural operations and one demanding a large degree of hard labor, labor of the most arduous character; consequently the adaptation of machinery to ditching is very desirable; but most machines heretofore produced have been too costly and too cumbersome to come into general use. The machine shown in the accompanying engravings is intended to supply a want generally felt by farmers. It is comparatively light, easily worked, simple in its parts, and efficient.

It consists, first, of a horizontal triangular frame, the wide or rear end of which supports the main axle, carrying two broad faced driving wheels. The apex or front end of the frame has a guiding wheel, swiveled by a king bolt to turn in any direction. The main axle has secured on it, just inside the driving wheels, two chain wheels of somewhat smaller diameter, which, by means of chains, give motion to a cross shaft hung on a transverse frame rising from the frame near the rear. This shaft, by means of a suitable wheel at its center, impels an endless apron composed of a series of scrapers which, at the front end, pass over a similar wheel near the ground. Under this endless apron is an inclined trough, adapted in depth and width to the scrapers, and armed at the lower end with a pointed plow. The depth to which this plow is adjusted is governed by a screw seen directly back of the driver's seat. When not working, the plow may be raised entirely above the surface by this means. An examination of the large engraving will explain these parts without the necessity of letters of reference.



CONARROE'S BUCKEYE DITCHING MACHINE.

Fig. 2

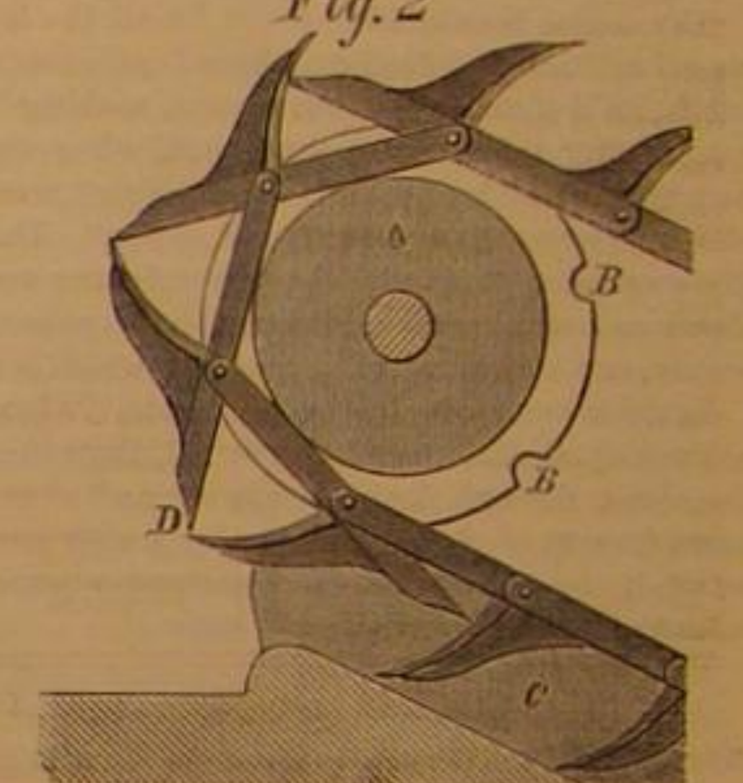


Fig. 2 gives the details of the scrapers. A is a section of the upper wheel over which the scrapers pass. These are pivoted together about midway of their length; the pivots projecting to engage with the semi-circular recesses, B, on the flanges of the wheels. These pivots operate, also, as fulcra on which the scrapers turn. As the scrapers travel up the inclined trough, C, bringing the earth with them, they successively turn on the wheel, as seen, their projecting back ends sweeping the face of the scraper next in the rear until they assume the position represented at D, when the earth is thrown out and falls on a V-shaped incline that deposits it on either side of the excavation. This incline and guard are represented in the large figure.

Patented, Nov. 19, 1867, by Robert Conarroe. A patent for recent improvements is now pending. For machines or other information, address Conarroe, Young, and Smyers, Hamilton, Ohio.

WRITE LEGIBLY AND INTELLIGENTLY.

The grand object of putting language on paper—of writing that others may read—is to give to the reader the ideas in the mind of the writer. This cannot be done if the writing is illegible. A large part of the annoyance of editors—those who attempt to give to the public the ideas of their correspondents through the organs (papers) they conduct—is occasioned by the neglect of their correspondents to write legibly. Not infrequently we receive articles containing *facts* that *should* see the light, and theories which should be brought to the notice of our thinkers; but they are frequently presented in such a garb that it is more than they are worth to pick out the grains of wheat from the ocean of chaff. Many of these communications have been laid quietly aside in our oblivion box, which if presented in any reasonable shape would have appeared in our columns. We do not allude only to valuable communications from those who have never had the advantage of a grammar school and do not understand the rules of orthography, but to those who have an idea on mechanical or scientific subjects but are themselves befogged and do not know how to present it, simply because they do not understand it.

If one has an idea, he should thoroughly understand it himself before he attempts to impart it to others. If he cannot put it into grammatical or journalistic form, that is his misfortune, and on this paper, as least, will not prevent him from a hearing from the great public reached by the Scientific American; but if he does not, himself, understand what he attempts to write about, it is too much to require that the editors of the the paper should do the work which his incompetency prevents him from accomplishing. If correspondents of newspapers and magazines would consider, never so slightly, the labor they impose upon editors in sending illegible and incongruous articles intended for publication they would take some pains to prepare their articles for their insertion.

GROSS' PATENT COMBINED LETTER OPENER.

The ordinary methods of opening letter envelopes by means of an ivory paper cutter, a knife, or the handle of an eraser, is slouchy and in many cases destructive to the envelope, the preservation of which is sometimes very important in settling disputes, either in or out of the courts. Very methodical men carefully cut the end of the envelope with scissors; but when the inclosed letter fills the envelope, as it frequently does, there is danger of mutilating the letter and its contents, which is not comfortable in the case of a dunning letter or one containing greenbacks. The engraving, however, shows two adaptations of a simple device intended for opening letter envelopes, and useful, also, for ripping seams in garments and similar purposes.

Fig. 1

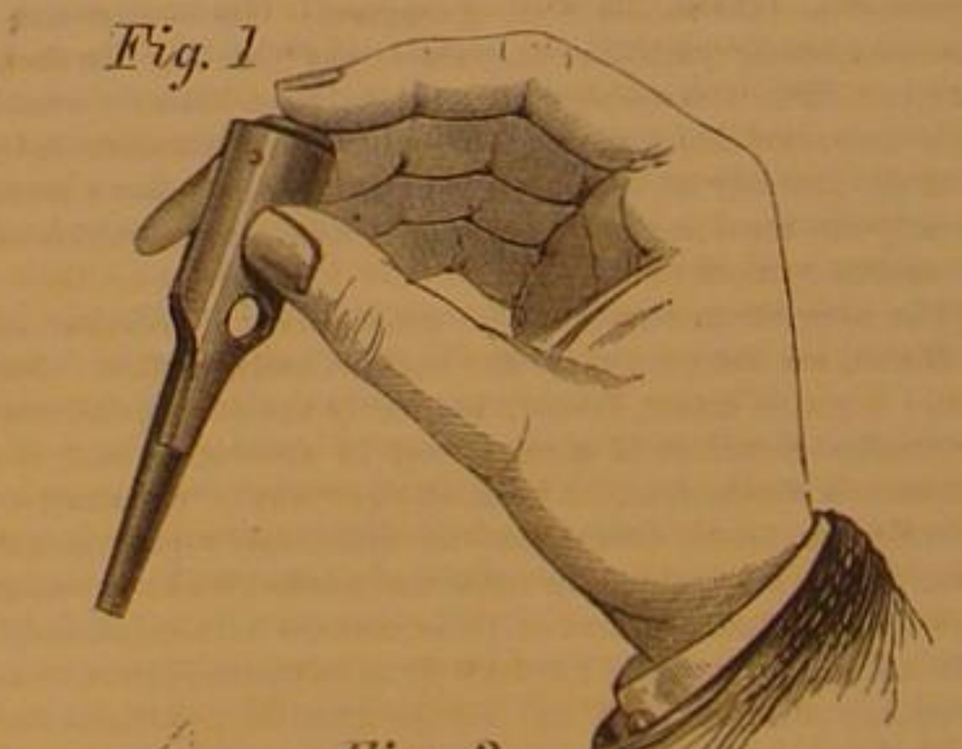


Fig. 2

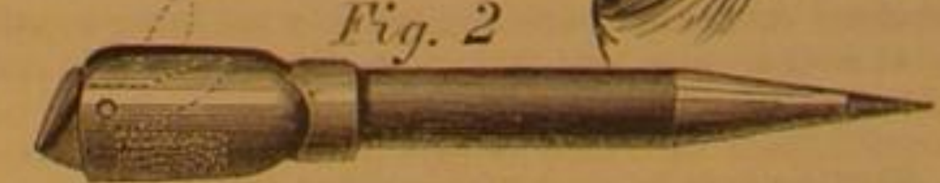


Fig. 1 is the device in the form of a watch key, and Fig. 2 the same, forming the head of an ordinary lead pencil. The device is very simple: it is merely a blade, like a diminutive pen-knife blade, held in a sheath or handle of metal, and so formed and pivoted that a light spiral spring, inside the sheath, keeps the blade inclosed until pressure is applied by the finger to the projecting head of the blade. This construction is plainly seen in Fig. 2. In Fig. 1 the manner of using it is exhibited. It forms an ornament to the watch guard or a neat head to the pencil, to which it is attached by a screw thread in the socket.

Patented by Henry Gross, Sept. 8, 1868. All orders should be addressed to Gross, Lysle, & Co., Tiffin, Ohio.

Two large steamers, each 246 feet long, have just been despatched from New York to China. They are to sail on the Yangtse river.

SMALL-POX AND VACCINATION.

The scourge of small-pox has, it is well known, visited the city of San Francisco during the past season with frightful severity. Fears have been expressed that it would, in spite of the precautions taken to prevent its spread, visit the large towns in the Atlantic States. In view of these facts we copy from the *Pacific Medical and Surgical Journal*, facts upon which the public should be posted at all times, and which are of special value upon a threatened invasion of this horible disease.

"Small-pox does not tend to spread extensively in a city or district, unless quickened by an epidemic influence. It may exist in a city constantly, from year to year, a few cases at a time, without displaying an active contagion.

"During an epidemic aggravation *recent vaccination is the only safeguard*. Persons who have had small-pox, or who have been exposed to it in former years with impunity, as nurses and the like, are not secure from attack.

"The duration of an epidemic is from six months to a year. The disease seldom progresses steadily, but fluctuates without relation to the sensible changes of climate. Winter is the season most favorable to its prevalence.

"During an epidemic of small-pox, other diseases are more frequent and more fatal.

"Foul emanations from sewers and so forth have little to do with it. They affect the general health, but do not promote in a marked degree the spread or duration of the epidemic.

"When the disease is not epidemic, the morbific germs emanating from a patient soon lose their vitality. But when an epidemic influence prevails, these germs resist decay and infect the entire atmosphere. They do not cause sickness unless the condition of the individual be favorable to their development. In an infected city, many persons—perhaps most of the inhabitants—receive them in the blood without injury.

"Disinfectants, such as chlorine, carbolic acid, the fumes ef sulphur, etc., will not destroy the germs of small-pox, unless they are strong enough to destroy human life. Sunlight, air, and heat are the best disinfectants. Clothing is perfectly disinfected by baking in an oven, or exposure for a short time to a heat at or above that of boiling water.

"The period of most active contagion is after the appearance of the eruption and during the process of scabbing. It is questioned by some good authorities whether the disease is contagious at all prior to the formation of pustules.

"Vaccination will not take perfectly a second time in more than one or two out of every one hundred persons.

"It will take partially, with some resemblance to the genuine cow-pox, in twenty-five per cent of the cases. Here the presumption is that re-vaccination was useful.

"A large scar is no evidence of genuine vaccination, nor is a large and painful sore. A spurious pustule is apt to be worse than the genuine vaccina.

"When re-vaccination is not followed by itching, or any other effect, it should be repeated. The virus may not have been active.

"No other matter should be employed than the lymph or crust from the first vaccination of a healthy child; or that taken from the cow. There is less uncertainty in the former than the latter.

"The crust should never be kept long after mixing it with water. It develops a virulent poison.

"Evacuation of the pustules is advised not only to prevent pitting, but as possibly serviceable in lessening danger from secondary fever, and as a case in point it is stated thus: An entirely unexpected recovery of a very bad case, was effected by the patient opening of the pustules and wiping away of the matter by the wife of the patient, rapid improvement taking place at the time when the dreaded secondary fever should have set in."

India Rubber Liquid Blacking.—Take of ivory black, sixty pounds; molasses, forty-five pounds; gum-arabic dissolved in a sufficient quantity of hot water, one pound; vinegar, twenty gallons; sulphuric acid, twenty-four pounds; India rubber, dissolved by the aid of heat in nine pounds of rape seed oil, eighteen ounces; mix them well together. This blacking may be applied by means of a small sponge, attached to a piece of twisted wire, like the well-known Japan blacking.

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NEW YORK, SATURDAY, APRIL 10, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

THE NATURAL HIGHWAYS OF TRAVEL.

While in other countries the artificial means of intercommunication are works undertaken, completed, owned, and managed by the government, our policy has been to leave these matters to private enterprise, or to the management of corporations chartered for the purpose; although where the work was a matter of national necessity, or advantage, appropriations in aid have been made from the public treasury, and privileges have been granted to the stockholders who raised the principal means and carried forward the work. In many cases this assistance is judicious, and whatever may be the opinion as to the extent to which corporations may be thus aided, it is certain that such work as is necessary to keep open and in order our natural highways, as navigable rivers, belongs properly to the national government.

The rivers and lakes that form our splendid system of natural intercommunication are, and should be, free to all, and no company or corporation, should be allowed to obstruct them for their own benefit. The right of locomotion, even if not laid down in any bill of rights, declarations of independence, or constitutions, is one as inalienable and unquestionable as that of breathing. Especially is this right necessary in a country like ours, of such vast territorial extent, of such diversified topography, varied climate, and difference of products. By cheap and unobstructed communications the sectional interests become national and the parts become a whole, exemplifying our national motto, *E Pluribus Unum.*

We, therefore, regard the obstruction of a navigable stream as a national rather than a sectional calamity, but a calamity nevertheless, whether viewed in a general or local sense. If the resources of engineering talent were exhausted, in carrying railways or common roads across navigable estuaries and rivers, only by means of short span bridges supported by frequent piers, or bridges of too low an elevation to admit the passage of vessels without raising or swinging a draw, there might be reason in thus obstructing natural highways for the benefit of artificial ways deemed to be more valuable. But where a single span of trestle work or arch is not feasible, the suspension system is practicable, in most cases; or if neither of these is advisable, or possible, a tunnel may be substituted. There are few localities where the tunnel may not be used. It may be built on shore, in sections, if required, and sunk to the bed of the river, or on piers laid for its support, of of sufficient hight to level the inequalities of the river bottom.

The superior cheapness of water carriage, especially for heavy and bulky freight, should be sufficient inducement to preserve intact our navigable rivers, and to improve them by the removal of obstructions that accumulate by natural agencies, rather than to add to these obstructions by building piers in the water way to act as *nuclei* for the accumulation of silt and the formation of sand bars. That this is the effect of such structures no observing person can doubt. Above the pier the current deposits its load of sand, gravel, etc., making an elongated ∧-shaped shoal; and below, the cross currents, by their eddies, do the same thing, so that on either side, in time, there is deposited an island of an elongated lozenge form, its longer diameter extending many yards both up and down stream, the pier itself being the center. Such obstructions, if formed by nature, either in the channel or on its borders, would be deemed, as they are, obstructions, and demand removal. That they are the result of artifical erections does not remove the objection to their formation. It is certain that, from what cause soever these obstructions occur, they are inimical to navigation, and to means of intercommunication, and, therefore, unworthy of toleration. Our rivers should be free, as free from artificial obstacles as from legal exactions.

THE SCIENTIST, INVENTOR, AND MECHANIC.

Not seldom the functions of these three great departments of human knowledge and progress are merged into one, so far as general opinion may reach, while the fact is they may be as distinct as any separate departments in any one art. The scientist deals with the qualities of matter and the laws which govern them separately or in combination. He is, or should be, in close communion with Nature, a student in her school, and a progressionist into her mysteries. He grasps the bare crags of knowledge, climbs to their summits, or explores their caverns. He notes the substances with which Nature works and the methods and agents of her working. Sometimes from the knowledge thus gained he becomes, himself, an inventor, but usually his investigations are too absorbing for him to relax his efforts in this direction, and he is satisfied with the almost endless vistas that open to him as he clears away the rubbish left by previous explorers and surmounts the obstacles placed by Nature herself. It is a noble department of human endeavor, as its demands are large, its obstacles formidable, and its rewards glorious. Moreover its field, although patiently worked by his predecessors, is ample enough for the exercise of all the energy and determination of the scientific explorer. However many may have scoured the ground before him, there are points of interest they have never seen, and mines of wealth they have never discovered—only dreamed of. But even if the scientific explorer is content to traverse paths already worn bare by the feet of his predecessors, he will not infrequently find unnoticed flowers by the roadside and rejected gems in the dust of the way. He prepares the way, by his accumulations of facts and his series of theoretical suggestions, for the inventor, who asks only the opportunity and means to give a living form to the scientist's discoveries.

The inventor must have a practical mind, whether he has a practical knowledge of mechanics or not. The constructive faculty is absolutely necessary to the inventor. He takes the facts discovered by the scientist and gives them form, which the mere student never could have done. In his hands the crude or bare facts of scientific investigation, in connection with the experiments necessary to their development, assume form and may be brought forth into useful shapes to bless and assist toiling millions, instead of merely astonishing and entertaining gaping audiences. The curious experiment becomes under him the useful possibility; the discovery of the student becomes to him a suggestion of practical use; facts, or even possibilities, are to him living realities.

But it is the mechanic who elaborates the idea of the inventor. He it is who clothes it with a practical form, furnishes it with nerves of steel and muscles of iron, and endows it with life and motion. Without his skill the result of the scientist's search and of the inventor's thought would be comparatively valueless. Indeed, his skill is frequently the only means of making the inventor's idea useful. In short, the mechanic, who as the model maker elaborates the inventor's idea, is often the real inventor. The crude, unworkmanlike contrivance of the inventor, that in his unskillful hands is merely a travesty on a machine, is made to assume form, proportions, elegance, and efficiency. So valuable is mechanical skill to the perfection of an invention that it is not surprising that practical mechanics constitute the large proportion of inventors. But if valuable inventions are often made by unskilled persons, it is seldom they are successful until after they have passed through the hands of the mechanic; and sometimes the addition or alteration, made by the mechanic and modestly termed an improvement, is the element of the inventor's success.

THE PRESERVATION OF TIMBER.

Perhaps the solution of no modern engineering problem has been more earnestly sought than a cheap, reliable, and universally applicable method of preserving timber. Although methods have been devised which approximately fulfill these conditions, there has yet been nothing attained that is suitable for universal adoption in architecture and in other branches of the arts.

It would appear at first sight an easy matter to preserve wood from decay, when it is remembered that the chief causes of decomposition, at least the chiet immediate causes, are changes in its hygrometric condition. Rapid successions of dampness and dryness will speedily destroy most species of timber. There are a few species which are naturally protected by essential oils contained in their texture, but such woods are too rare and valuable for general use.

The physical characters of different kinds of timber afford the clue to the difficulties in solving this problem. Wood is a porous material of great absorbent power upon nearly all kinds of liquids. Many kinds will absorb their own weight of water under favorable circumstances, and part with a large portion of it again when exposed to warm currents of air. To preserve such woods from decay implies the stoppage of the pores, by filling them with some impervious substance or the saturation of the timber with some antiseptic material.

No process based upon either of these principles has as yet been discovered not attended with some drawbacks. Either the process is expensive, or the texture and grain of the wood suffer change, or its natural beauty is marred so as to render it unfit for ornamental work. The latter consideration may be left out of the account, when wood is to be applied to the coarser purposes of engineering, as piles, railroad-ties, pavements, etc., but the item of expense tells more heavily in these cases than in ornamental work, where the cost of the material is a small item in the cost of the structure.

But natural decay is not the only destructive agent against which it is desirable to provide. One of the greatest objections against wood for building purposes is its liability to destruction by fire. Many processes have been devised to remedy this evil, and although a recent Italian process has been favorably spoken of as being free from the objections pertaining to processes of earlier date, it is quite probable that further news respecting it may not be so favorable.

So far as we are aware, no process has ever been discovered that could be very cheaply applied to both the preservation of wood from decay, and also from fire, and which at the same time could be relied upon as certain. The most simple and the cheapest method adopted, has been that of the application of fireproof paints; but paints are liable to crack upon exposure, and from the natural shrinking and springing of timber, and thus give access to moisture. This method has been only partially successful.

It is impossible to give here anything like a detailed notice of the various wood-preserving processes. A whole class of them is included in the impregnation method, in which different chemicals possessing antiseptic properties have been forced by pressure or absorption into the pores of the timber. Sulphate of zinc, sulphate of copper, corrosive sublimate, creosote, carbolic acid, coal tar, etc., have been employed, the three last with the best results yet attained, so far as preservation from natural decay is concerned. None of these processes have been without failures in some instances. So far as these failures relate to the creosoting of wood, they are doubtless due to the imperfections in the method of performing the work. Sulphate of copper has also been used quite successfully but is expensive. The use of coal tar products is the cheapest method yet devised, but it is obviously unadapted to use where a finish is to be given to wood. The smell of timber thus preserved is also an objection to the process. We see then that anything like a perfect process for preserving timber under exposure to high temperatures and variations in hygrometric condition is yet to be devised. It may be that it is impossible to invent any method that shall cover all the conditions of the problem. The rich reward, however, which most certainly awaits the fortunate discoverer of such a method, ought to stimulate experiments in this field and give the world something far ahead of anything yet proposed.

VENTILATION IN BUILDINGS.

The topic of ventilation has been discussed and re-discussed, and a library might be collected of books and lectures and reports of learned societies upon the subject; yet churches, theaters, school houses, and private houses, judging from universal complaints, still remain unventilated. We hear, indeed, from time to time, of success in the use of apparatus for ventilating capital buildings, or parliament houses, but when circumstances compel us (as they do occasionally) to visit some such place, we find but little to praise in this respect. We however moderate our disappointment when we reflect how very difficult it must be to keep a pure atmosphere in these places. For the most part buildings in which people congregate are ventilated about as well as a certain horse car, the unwonted brilliancy of whose lamps elicited some inquiry on the part of a curious passenger. The phenomenon was explained by the scientific conductor's pointing out some flues admitting fresh air from the outside to the small cells inclosing the lamps, in order, as he learnedly stated, that the foul air from the lungs of the passengers might not totally extinguish them.

The amount of learning displayed in discourses on ventilation would make even our scientific conductor open his eyes. Few indeed who have not given a lifetime to the study of this important subject, can be aware of the intimate relations existing between the geological periods and the scientific mode of getting bad air out of a room and replacing it with pure air. It would be still more preposterous to suppose that ordinary practical minds could be able to grasp this subject without being first well grounded in the cosmical theories of La Place, and the "Principia" of Newton. In short the subject embraces, if the harangues and discourses of Professor this or Doctor that are any index to its magnitude—all the knowledge as yet attained by mankind, with a very large proportion of what is yet unattained.

An English journal states that Dr. Edward Smith, F. R. S., read a paper on ventilation before the Society of Arts, on the evening of the 24th of February, in which he treated the subject *comprehensively without recommending any particular plan.* Treating the subject comprehensively is the mode. Of what use is it to descend to particulars when so much science can be displayed in generalities? Of what use is it to teach others if we fail to show that we ourselves are learned?

The fact is that the science of ventilation is small, the art is easy, and the learned discourses which have lately dragged their tedious lengths along in the *Journal of the Franklin Institute*, and have burdened the pages of many other scientific journals, as well as the patience of their readers, are called for no more than learned discussions upon the problem how to avoid cutting two holes in a back door to let out two cats, one being a large one and the other a small one.

We have many times urged the supreme folly of treating the subject in the ridiculous manner described, and have given rules, the simple observance of which will insure well ventilated apartments. To apply these rules requires common sense, mechanical skill in construction, and arithmetic; "only these and nothing more." It seems, however, that upon this as upon many other subjects upon which we write frequently, we must repeat our lessons often. There is no subject upon which we receive so many inquiries.

First, then, the fundamental law upon which ventilation is based is, that hot air rises and cold air descends. It follows if the pure air admitted to a ro m be heated by a furnace, the impure air which is cooler will settle to the bottom of the apartment, at which the registers for its escape ought to be placed. If the room be heated by radiation, as with steam apparatus, stoves, etc., and the pure air be admitted cold, the registers should be at the top of the room.

Second, good ventilation can not be secured by using long flues, unless mechanical appliances, as fans, etc., or apparatus for heating them are employed. The air gets cold before it passes through them, and consequently ceases to rise, or rises but slowly. The best thing for this purpose is an open grate at the bottom of the room having for its chimney the flue through which the foul air is desired to pass.

Third, strong winds over the unprotected external mouths of flues, are apt to reverse or obstruct currents. The mouth of every flue should be covered with a hood so adjusted that it can rotate with the wind. The winds blowing from any quarter will thus aid rather than impede the egress of air from them.

Fourth, they, as well well as the flues for the admission of pure air, should be made of a size proportionate to the requirements of each particular case. Here the arithmetic comes in, and the data are as follows:

The number of respirations in a healthy adult per minute, is from 14 to 18. The average amount of air taken into the lungs at each respiration is about twenty inches. From this air the oxygen is removed, and its place supplied with carbonic acid at the mean rate of ·0435. From these figures it is easy to calculate the rate at which fresh air must be admitted to supply the demand or (as admission of fresh air implies in any proper system of ventilation the removal of foul air) the rate at which the foul air ought to be removed. The size of the escape flues ought to be proportioned to the size of the room, and the number of people it is intended to contain, which can be easily done by any competent architect. To those who are not competent we say, err if you must on the safe side, make the hole large enough for the adult cat and the kitten will also be accommodated. Of course if a building is not constructed so as to admit of proper ventilation, it will be impossible to ventilate it properly, a statement so logical that even Dr. Edward Smith, F. R. S., will not dispute it.

Fifth, the admission of pure air should be so adjusted when the air is not previously heated that all sharp drafts shall be avoided. This can easily be done by causing it to enter through wire gauze, breaking the currents by screens, etc., in the application of which means, common sense is of much more value than large scholastic acquirements. Thus ends our discourse upon ventilation, which if not so learned, will, we are confident, do more good than that of Dr. Edward Smith, F. R. S., before the Society of Arts, above mentioned.

TASTE AND SMELL--A NEW THEORY.

A scientific gentleman, in a recent conversation, broached to us a theory of taste and smell, which, so far as taste is concerned, is, we think, new. A similar theory in regard to smell has been propounded by Piesse, and is, we think, the true one.

The theory of odors hitherto accepted, has been, that invisible particles, emanating from bodies, and coming in contact with the olfactory nerves, produce the sensation of smell. Substances to be odoriferous, need, therefore, to be volatile to a certain extent.

Taste, says one author, "is merely a more delicate kind of touch." The nerves of the whole interior of the mouth are the ones supposed by some to be endowed with this "delicate touch," while others limit the nerves of taste to certain parts of the mouth, of which the tongue is chief. In general, substances insoluble in the fluids of the mouth, are regarded as being destitute of taste.

The nerves of special sensation have been a subject of most profound study on the part of physiologists, who have never yet been able to find in their anatomy or composition anything to account for their peculiar functions. Knowledge bearing upon the subject, therefore, relates principally to the external phenomena of special sensation, and it is to these that the theory of which we write entirely pertains.

The phenomena of sound have all been referred to vibrations of sonorous bodies, transmitted to the complex mechanism of the ear, by solid, liquid, or gaseous media, or a combination of such media. The phenomena of sight are also referred to vibrations of luminous bodies, transmitted to the eye by a medium called ether. In these sensations actual contact of the body, which is the primary cause of them, is known to be unessential. The new theory of taste and smell brings these sensations also into the category of impressions produced by vibration. In other words, these sensations are attributed to vibratory motions in external bodies, a knowledge of which is communicated to the mind through the nerves of taste and smell, in a manner analogous to that in which impressions caused by light and sound, are transmitted to the mind. In the case of taste, it is possible that no medium exists that can convey its impressions; the communication of such impressions must, if this be the case, be immediate, that is, the tongue must touch, in the popular sense, the thing tasted. There are, however, difficulties connected with this hypothesis, viz.: How are we to account for the absence of taste when insoluble substances are placed on the tongue? How, if fine division and intimate contact with the nerves of taste is essential to this sense, are we to account for the absence of taste when certain gases are taken into the mouth? Certainly, in the latter case, we have the minutest subdivision and as perfect contact, as is physically possible to obtain. It becomes evident, then, that there are bodies incapable of affecting this sense, as there are bodies which are non-luminous to the eye, and others which, to the ear, are deficient in sonorousness.

But, supposing no known medium to be able to convey impressions of taste to the nerves of that sense, the theory of vibrations does not, on that account, become untenable. We are far from believing, however, that the subject has been studied sufficiently to pronounce with certainty upon this point.

The corpuscular theory of light has been discarded as failing wholly to account for optical phenomena. In like manner have the theories of phlogiston and caloric successively given way to more enlightened views. Both light and heat are now considered as modes of motion.

If now we retain the corpuscular hypothesis for the sense of smell, we suppose that to be the most delicate of all the senses, for by it we may, without artificial help, detect quantities of matter so small that they can be detected by no other sense, even though aided by the most powerful instruments science has been able to devise or art to construct. If we consider the act of smelling as only a more delicate kind of touch, as it has hitherto been thought, we suppose the power of sensation in the olfactory nerves infinitely superior to any others. Some illustrations will make this appear in a stronger light. A grain of musk exposed for six months in a large room, communicates its odor to all the bodies in the room, *without any sensible loss of weight.* If a handkerchief thus perfumed with musk, be exposed to the most critical examination by the microscope, no musk can be detected deposited in its fibers. But, it may be said, the odoriferous principle exists in a gaseous state. If this were so, it might be reasonably supposed that delicate chemical tests would afford a trace of its presence, but they do not. Does not, then, the vibratory theory conflict less with the facts in this case than the theory of emanations? The only grounds we have upon which to base the hypothesis of emanations is a sensation produced, and we have the same ground for believing that light and heat are emanations.

But, it may be asked, how can the smell in the handkerchief be accounted for if the musk be not present? To this it is answered, in the same way that sensible heat in a body is accounted for, after it is removed from a contact with another heated body, or fluorescence in bodies after exposure to sunlight. These phenomena are referred to the continuance of vibrations in bodies after the exciting cause is removed. It does no violence to analogy to suppose the same cause as continuing the effect of an odor, after the primary cause is removed.

A bar of block tin, when rubbed, emits a peculiar smell. No test, however delicate, can demonstrate the presence of metallic particles in the air or of the oxide or salts of tin, in this experiment. Applying the same reasoning adopted in relation to sound, heat, and light, it is extremely difficult to believe that smell, in this case, in produced by actual contact.

It is well known that perfumes blend harmoniously when combined according to a scale, which may be represented by a gamut, in which different odors correspond to different musical sounds; and the other analogies between smell and sound are indeed very striking, as is shown by Piesse, in his work on "The Art of Perfumery," second section.

A wide field of study and experiment is here opened, and, we have no doubt, that in future works on physics, the subjects of odor and taste are destined to find a place by the side of heat, light, sound, and electricity.

BEET ROOT SUGAR.

No. III.

CULTURE OF THE BEET.

CLIMATE.—Few of our cultivated plants thrive under more varied conditions of climate than does the beet. It is grown in Europe, from the shores of the Mediterranean to very near the Arctic circle, and from the Atlantic to the Caspian Sea, so that in few portions of the United States would meteorological conditions offer any obstacle to its successful cultivation. The relative season for sowing, so that it can be harvested in the right time, can be so regulated by the intelligent cultivator, according to the degree of latitude, so as to suit the exigences of the manufacturer.

Heat and moisture being needed in considerable quantities for its perfect development, very cold or very dry localities will alone prove antagonistic to its profitable production as a sugar plant.

The seed germinates at a temperature of 44° Fah.; the root rots on thawing if exposed to a cold much below the freezing point.

SOIL.—The beet vegetates in all soils, but a sandy loam or an argillaceous soil is the best suited to its nature. In chalky soils or very sandy ones, its development is stunted. It prospers in light, silicious ground if this be rich in humus or in manure. A medium consistence between stiff and light is the best for it, but too stiff soils are preferable to too light ones.

The soil for beets must be loose, fresh, and free from stones. If water is contained in the subsoil, it must be artificially drained.

A certain amount of lime in the soil is advantageous, but it must contain no *excess* of potash or soda, as these salts have a deleterious influence on the ulterior production of sugar during the process of manufacture.

It is best, for many reasons, not to grow beet as a first crop on newly-cleared lands. This plant having a long, taper root, the radicles of which penetrate far down into the ground, the necessity of a deep and well-pulverized soil is apparent.

PREPARATION OF THE GROUND.—The instructions for this purpose may be summed up as follows: Plow deep in the autumn or early winter; better twice than once. This may best be done by means of two successive plowings with an ordinary plow or by the use of a subsoil plow. The following spring pass a heavy iron-toothed harrow over the land, and follow this soon after by a scarifier. After this, spread your manure equally over the land and plow it in to a depth of four or five inches.

Harrow and roll with an iron roller so as to equalize the surface and break up clods, and the field is ready to receive the seed. These last operations must, if possible, be performed before the month of April.

SOWING.—Our instructions in this case are: In the first place, purchase your seed, fresh imported, from a reliable dealer, or import it yourself until you can make your own (which will require two years). The amount needed per acre will be from ten to twelve pounds, which can be purchased in New York, at present prices, at 50 cents per pound, for small quantities of from ten to fifty pounds, with a very liberal discount for larger amounts.

The seed, before sowing, is soaked in water for 24 hours, and piled up into small heaps until signs of approaching germination are manifested. It is then rolled in fine dust-bone black, which forms a dry adherent coating.

The land by this time must have been very carefully "marked," or laid out in regular superficial lines or grooves running at right angles to each other. This is done by means of a special implement drawn by a horse. These lines are so distanced that those in one parallel series are placed at one foot six inches, and those in the other at one foot ten inches from one another. One beet root is destined to be grown at the angle of each quadrangle formed by these intersections, so that one acre of land produces between 21,000 and 22,000 beets. The marking has to be done with great accuracy, as the subsequent horse hoeings would be impossible if the regularity of the rows was imperfect.

The seed is sown by manual labor or by horse power. In the first case this is done by special hand machines, which rapidly deposit the seed along with a minute quantity of some dry, pulverulent fertilizer at the angle of the square "marked," as above described. It is then covered by passing a roller over the ground.

More generally, however, the seed is drilled into the land by a sowing machine, drawn by one or two horses, that sows several rows at a time. These machines, of which many various kinds are at present in use in Europe, generally open a groove in the ground, drop the seed in a continuous stream into this groove, deposit along with it a small amount of superphosphate or other finely-comminuted fertilizer, and finally cover the seed, all in one operation. The seed ought to be buried at a depth of from $1\frac{1}{2}$ to 2 inches.

If the season is propitious, the young plants will show themselves above the surface in from eight to twelve days.

The time of year for sowing the seed must, in the United States, vary according to localities, from the 1st of March in the Southern States to the first week in May in the Northern. The average for our Middle States, East and West, would correspond to about the 15th of April, or as near to this date as circumstances will allow.

CARE OF THE GROWING CROP.—Very soon after the young beets have fairly shown themselves, or even before this, if weeds are thick, and the original drill lines or marks are still visible, a horse hoe is lightly run across the field between the 18-inch rows.

This implement is made to take from three to five rows at one time, in which cases it is, respectively, drawn by one or by two horses. As soon as this operation has been performed, the small beet plants are "thinned" in the rows by means of a broad-bladed hand hoe, which is by two successive strokes of the laborer made to clear a little less than one foot ten inches of the space to be left between two plants in the same row. With skillful drivers this operation may also be performed by the horse hoe; the implement in this case being so constructed as to allow of varying at will the distance between the hoes.

A workman, or woman, with a small, short-handled grubber now follows, and stirs the earth carefully around each plant, so as to loosen the soil, and to leave only one beet at the end of each determined interval.

A few rows of young beets must be left in each field untouched, or only "thinned," in order to allow by transplantation the filling up at some future period (generally after the second hoeing, or when the root has attained about half an inch in diameter) of any vacant spaces in the line produced by the non-germination of seed, late severe frosts, or other accidental causes. The transplanting is done by hand, and the replanting with a blunt-pointed, hard, wooden borer, great care being taken not to injure the young roots when taking them up or during their transportation. These last operations are often satisfactorily performed by means of a "*deplantoir*," or "transplanter," a special instrument constructed for the purpose.

After this period, two successive horse hoeings will, in most cases, generally suffice to keep the ground clear of weeds until the foliage of the beet itself will become a self-protector by smothering all spontaneous vegetation between the rows. In some instances, however, when the soil is particularly foul, or when it has become caked by the combined influence of excess of rain and heat, it may become necessary to repeat the hoeings once or twice more, and it may prove beneficial to "earth up" the beets, either by means of special contrivances adapted to the horse hoe itself or by using a very light moldboard plow.

As the plant is a biennial, harvested during the first year of its growth, it cannot be called ripe or mature at any time before maturation of seed, but the proper season for its extraction is indicated when the thermometer in the autumn months has, during several successive days, fallen as low as 45 or 50 degrees of Fahrenheit's thermometer, and when consequently the first frosts may be anticipated.

HARVESTING.—This is done with hand graips, or much better with a mold-board or gridiron plow, the coulter of which has been removed.

The plants are taken up, well shaken, and laid in rows, with the roots pointed all one way. The tops, or collars, are then cut off by means of a strong, heavy, sharp knife, which does the work by one stroke.

Care must be taken to "decapitate" the beet root fully, so as to prevent vegetation or sprouting of new leaf buds during the winter months, which would develop themselves at the expense of the sugar. The roots must be cleaned, but without excess, as a little dirt left on them will hurt them much less than rough handling and bruising.

The season for harvesting will vary from the beginning of September to the end of October, according to localities, seasons, and periods of sowing the seed. The later the harvest is gathered the more advantageous will it prove to be in the end to the manufacturer.

PRESERVATION.—The beginning of the beet root harvest and of sugar making for the campaign are simultaneous. The beets needed for immediate consumption, or for use within a few days after the gathering, are laid in the open air in layers, which must not exceed three feet in thickness, and must be frequently stirred if their sojourn is accidentally prolonged beyond this length of time.

The roots destined to be worked during the winter months must be preserved from frost, and are placed in long trenches dug in the ground near the factory buildings. These trenches are generally made about ten feet wide and seven and a half feet deep. Their bottoms have a gentle slope from each side toward the center, where longitudinal drains are dug out for the purpose of collecting any water which might percolate through the pile of beets. This water is carried off by a long, narrow ditch, dug at a lower level than the trench, and put into connection with it by means of drainage pipes.

The bottom of the trench is next covered with small poles or faggots, laid across so as to bridge the central drain, and the beet roots are carefully filled in, care being taken to leave air holes or chimneys (made by converging poles or boards) at distances of every twelve or fifteen feet. The beets are piled somewhat higher than the upper level of the trench.

As long as the weather remains fine, and no frost is apprehended, all that has to be done is to cover the upper surface of the beets with a few inches of straw, or dried leaves, in order to protect them from the action of the sun, which is apt to induce heating and consequent fermentation and putrefaction.

As soon as the cold weather sets in, a portion of the earth dug up in making the trenches is placed in a layer of from 1 to 2½ feet in thickness on the top of the covering of straw or dried leaves. This protection is only removed as the beets are needed for the supply of the works. One single thing has to be attended to during the winter, namely, to close the air holes or chimneys whenever the weather is frosty, and to open them on mild or rainy days.

PLACE IN ROTATION OF CROPS.—It is improvident, and bad farming to cultivate the beet root twice or more years in succession on the same piece of land.

In Europe it is brought once only in a triennial or quadrennial system, this last being preferable as requiring the labor of only one manuring during a period of four years.

Here are examples of rotations such as we can conscientiously recommend:

I.

1st year	Beets, manured.
2d "	Barley or oats.
3d "	Clover or sainfoin.
4th "	Wheat.
5th "	Beets, manured.

II.

1st year	Beets, manured.
2d "	Wheat.
3d "	Clover.
4th "	Rye or oats.
5th "	Beets, manured.

III.

1st year	Potatoes, well manured.
2d "	Beets, not manured.
3d "	Wheat.
4th "	Clover, hay, or some forage crop.
5th "	Potatoes, manured.

MANURE AND FERTILIZERS.—In order to obtain a twenty-tun crop of beet root without impoverishing the soil on which it has been grown, we have to return to it the whole of the leaves which were cut off at the period of harvesting, and further, to add by means of farm-yard manure, and by other fertilizers, either natural or artificial, the following substances per acre in the quantities here given:

Nitrogen	747	pounds.
Sulphuric acid	45	"
Phosphoric acid	166·5	"
Lime	189	"
Potash	1,125	"

These figures, with a large allowance for waste and losses, will allow intelligent agriculturists to make their own calculations as regards the needed quantities of the manure they may choose to employ. Let us remark, in conclusion, that during the processes of making beet root sugar many very valuable refuse, or so-called waste substances are produced, all of which are of the highest value as fertilizers, and are carefully collected as such. These are: The waste dust or refuse bone-black left after washing; the exhausted lime of defecation; the pressed scums; the worn-out woolen sacks from the pulp presses; the ashes from under the boilers; the small roots and rootlets from the root washer; and, finally, the dung of the animals fed upon the beet root pulp after the sugar has been manufactured therefrom.

Editorial Summary.

WE learn that a bill for the inspection of steam boilers has been introduced into the Pennsylvania Legislature. It provides that within thirty days the Governor shall appoint one suitable person, to serve for three years, in each Congressional district, as inspectors. They shall examine all except locomotive and low-pressure boilers, and shall keep a "lock-up" safety valve on each boiler. The owners shall have their boilers ready for inspection when notified, and shall pay four dollars for inspection, and shall attach a low-water indicator, connected with the steam whistle.

WORKMEN AND THEIR TOOLS.—A good test of a good workman—one of the best apart from his workmanship—is his care of tools. If he leaves a worn out or dilapidated tool in its imperfect state until he gets time to put it into shape, he lacks in the organ of order, which should be the shop's, as Pope says it is Heaven's first law. But if he repairs the tool soon as it is injured, whether wanted for use at the time or not, he can be depended upon. A carpenter may be known by his chips; but a workman at any business may be known by the state of his tools.

EFFECT OF TREES ON CLIMATE.—The dryness of the Egyptian climate is such that rain is unknown in Upper Egypt, and in olden time it never rained oftener than five or six days in a year on the Nile delta. The viceroy, Mehemed Ali, caused twenty millions of trees to be planted on this delta; these have now attained their full size, and the number of rainy days has increased to forty annually. Such is the power which man can exert over nature in the matter of varying meteorological conditions.

A "NEW England Mechanics' and Art Association" has been organized at Boston, of which ex-Governor Bullock, of Worcester, Mass., is President. The circular before us, which we are requested to notice, does not give any information respecting the purposes of the association, but we should judge, from the number and character of the gentlemen who are its sponsors, that a good deal may be expected from it.

MONUMENT TO HUMBOLDT.—It is proposed by a number of our citizens to commemorate the centennial birthday of Humboldt by the erection of a monument to his memory, in the Central Park, at a cost of $2,500. Subscriptions are solicited in behalf of this commendable undertaking by a committee of well-known gentlemen, of which Christian E. Detmold, of this city, is the treasurer.

IMPROVED PRINTING MECHANISM.—One of Bullock's patent presses, at the Government printing office, Washington, attended by two persons, does the entire work which recently required for its execution no less than eighteen of the Adams presses, coupled with the labor of twenty persons. The steam power used to drive the Bullock press is not much greater than that needed for one of the old presses.

INK FROM ELDER.—In a receipt for making ink from elder, on page 180, an incongruity has crept in. The sentence reading "add to 12½ *parts* of the filtered juice one ounce of sulphate of iron," etc., should read, add to 12½ ounces of the filtered juice one ounce of sulphate of iron, etc.

A NEW chemical laboratory, just completed at the University of Leipsic, is the largest and most perfect, in regard to its internal arrangements, of any in Germany. The corner stone was laid in August, 1867, and the building was opened to students in last November.

THERE are only seventy-five miles of rail remaining to be laid on the Pacific Railroad, and it is expected that a locomotive will run through to San Francisco early in the summer. The highest point on the road is 7,500 feet above the sea.

WE are out of some of the back numbers of this volume. Subscribers who write for missing numbers will always be supplied when it is possible for us to do so. We make this statement to answer several applications.

WE are indebted to General H. A. Barnum, of Syracuse, N. Y., for a copy of Report of the Inspectors of State Prisons, for 1869, for which he will please accept our acknowledgments.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

The new American Print Works, at Fall River, Mass., are nearly finished, and are filling with machinery. The Mechanics' Mills, in the same town, are receiving machinery, and will commence running in about three months. They will run 50,000 spindles, 1,200 looms, and will weave 13,000,000 yards of print cloths per annum.

A powerful steam saw mill on wheels is building at Worcester, Mass., It is to be moved about the country and used wherever wanted. The machine weighs twelve tuns.

Almost one thousand passengers were delayed along the line of the Union Pacific Railroad by the recent snow blockade.

It has been estimated that at present rates of cutting, the pine timber of Michigan will be exhausted in 17 years.

The Georgia White Oak Lumber Company have now in operation a floating steam factory turning out 1,500 finished staves per day.

Part of a brewery at Morrislana, N. Y., was crushedon Saturday by several thousand tuns of rock and earth falling upon it from a hill in the rear.

The Turner's Falls (Mass.) Water Power Company have leased 200-horse power, with privilege of 400 more, to a gentleman of New York, who will employ it in making paper pulp from poplar wood.

Two millions of cattle are, upon the authority of Letheby, killed annually in South America for the fat skins and bones solely.

A green corn company is erecting at Farmington, Me., a factory 100 feet by 60 feet and three stories in hight.

There are 107 cabinet manufacturing establishments in New York city, employing in the aggregate 3,000 men.

The Philadelphia Water Works supply water to 909 manufacturing establishments.

Kansas has already 600 miles of railroad in active operation.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

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

☞ *All reference to back numbers should be by volume and page.*

C. L. H., of Ohio.—An aqueous solution of gum-arabic is the best varnish for leaves and flowers.

W. S. S., of N. Y.—Your communication upon rat-proof buildings fails to explain how they should be constructed. In its present shape we cannot regard it in any other light than as an advertisement of a patent.

E. J. F. of Me.—An application of glycerin to the tubs will not injure the taste of butter, and the article is harmless. You can get it at the druggists.

L. O. B., of Ind., wishes to know a practical method of scouring wool oil containing petroleum, out of cloth or yarn. He says the yarn when this oil has been used, turns yellow after standing awhile, and never comes out as white as when pure lard oil has been used, and when he attempted to scour with lye or country soap, he could not get good results. Can any of our correspondents give the desired information.

Wm. S. C., of———The usual estimate of a horse power, 33,000 lbs. raised one foot in one minute, is the work that average horses will perform steadily with suitable machinery. The best method of applying the power of a horse to propulsion of machinery is in our opinion, the endless chain horse power in common use if properly made and set with reference to the machinery to be driven.

J. Van O., of Pa.—We have practiced the following method for drying chlorine gas, with excellent results. Take of pumice stone a quantity of small fragments the size of a pea, soak them in strong sulphuric acid, then calcine them until acid fumes cease to be disengaged. These fragments are then re-saturated with sulphuric acid and inclosed in a tube through which the gas is passed in the ordinary manner of drying other gases. The sulphuric acid will seize the water contained in the gas the latter passing over in a dry state.

J. E. C., of Iowa.—When the same length of belt is to be used to give different speeds, the centers of the pulleys remaining equi-distant, the diameter of the driver must be increased as that of the driven is diminished, or *vice versa* and the speed of the circumference of both the driver and driven pulley will increase exactly as the diameter of the driver is increased. The number of revolutions made by the driven pulley will be to the number of revolutions made by the driver, as the diameter of the driven pulley is to that of the driver. Thus if the diameter of the driver be 4 and that of the driven 2, and the number of revolutions of the driver be 60, the proportion will be, 2 : 4 :: 60 : 120 the number of revolutions made by the driven pulley.

F. P. H., of Mass.—We know of no "water-proof glue" for uniting wood. Many recipes are published which assume to be water-proof, but we do not believe in any of them, as glues are dissolved in water, and of course water will re-dissolve them. India rubber (virgin) dissolved. 4 parts in 30 parts naphtha, or benzine, and 65 parts ground or powdered shellac melted in it make as near an approach to water-proof glue as anything we know. It will also unite metal and wood if the surfaces are clean. Molesworth, in his "Engineer's Pocket Book" gives the following: "For a glue to resist moisture, melt 1 lb. of glue in two quarts o skimmed milk. A strong glue, add powdered chalk to common glue. His marine glue is similar to that, the formula of which is given above. We cannot tell you where "machines for plaiting silk fishing lines" are to be obtained.

J. S. C., of Pa.—We do not consider the question of the precise instant when the gun receives the recoil of the explosion—whether at the time of ignition of the powder, or when the bullet leaves the barrel, thus creating a vacuum—of sufficient value to occupy a space in our columns.

H. A. S., of Me., says he saw in the SCIENTIFIC AMERICAN about two years ago a statement of the erection of a flour mill in New York, to hull the wheat before grinding. He asks "What became of it and why don't the owners advertise?"

S. W. H., and Bro., of Mo., say that they use an exhaust pipe of tin, four inches diameter, for leading their exhaust to a heater. It drops two feet from the engine cylinder, traverses ten feet horizontally, and then rises four feet to the heater. In starting the engine March 5th, the horizontal portion collapsed. "What" they ask "is the reason?" The only cause is the pressure of the atmosphere without and a vacuum within the pipe. Probably an examination would show that the communication with the atmosphere was closed either by the action of the back pressure valve opening outward or by the water. Sheet tin is *in any case* a poor material for conducting steam.

W. S. T., of N. H.—Number of feet traversed by minute of your little engine is 562; pressure, about 4 lbs. on piston, result less than one-sixteenth of one horse power.

T. F. H., of Conn.—A good dark bronze dip is made by dissolving iron scales (scales from the forge) 1 lb., arsenic 1 oz., zinc 1 oz. in 1 lb., muriatic acid; the zinc to be added to the solution just before using. The metal to receive it should be cleaned by diluted acid.

L. V. G., of Ohio.—For an ordinary foot lathe for wood or light metal work, a wheel of iron from 30 to 36 inches diameter is sufficient for a driver, weighing 150 to 175 lbs. The live spindle should run in brass composition or Babbitt metal.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

BUOY FOR RAISING SUNKEN VESSELS.—Joseph C. Fuller, executor of the estate of Elisha Fitzgerald, deceased, has petitioned for the extension of the above patent. Day of hearing, May 31, 1869.

MACHINE FOR PEGGING BOOTS AND SHOES.—Alpheus C. Gallahue, of New York city, has petitioned for the extension of the above patent. Day of hearing, May 31, 1869.

MACHINE FOR MITERING PRINTERS' RULE.—William McDonald, of Morrisania, N. Y., has applied for an extension of the above patent. Day of hearing, June 14, 1869.

CARD EXHIBITOR.—Wright Duryea, of New York city, has applied for an extension of the above patent. Day of hearing May 31, 1869.

METHOD OF SECURING CUTTERS TO ROTARY DISKS.—Jonah Newton, of New York city, has applied for an extension of the above patent. Day of hearing May 31, 1869.

WATER METER.—Henry R. Worthington, of Greensburg, N. Y., has petitioned for an extension of the above patent. Day of hearing, June 28, 1869.

MACHINE FOR PUNCHING METAL.—George Fowler, of Seymour, Conn., has petitioned for the extension of the above patent. Day of hearing, June 7, 1869.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

Recent American and Foreign Patents.

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

STOVE.—John H. Boelker, Evansville, Ind.—The object of this invention is to improve the construction of cooking stoves in such a manner that when the "fire bottom" burns out and has to be thrown away, the whole of it need not be thus rendered useless, but the burnt portion can be removed and another piece, of similar construction, substituted in its place, while the hearth and other portions, not destroyed, remain undisturbed.

GIG SAW.—Isaiah B. Arthur, Sidonsburgh, Pa.—This invention has for its object a new and improved arrangement of the parts by which a gig saw is put in motion, whereby the machine is rendered easier of operation than heretofore.

DEVICE FOR CONVERTING ROTARY INTO RECIPROCATING RECTILINEAR MOTION.—Chas. F. Hadley, Chicopee, Mass.—The nature of this invention consists in the arrangement of means whereby a rotary may be converted into an even and continual reciprocating rectilinear motion, forming a substitute for the crank.

MOP HEAD.—John Fahrney, Boonsboro, Md.—The object of this invention is to provide for public use a neat, simple, and durable mop head, to which the mop can be instantaneously attached without the necessity of stooping or touching it with the hands, even though the mop, at the time, be lying on the floor or in the wash tub.

COMBINED WHIP SOCKET AND LINE HOLDER.—Joseph R. Finney, Youngstown, Ohio.—The object of this invention is to provide a neat, cheap, and and convenient device which shall serve both as a whip holder and rein holder, being attached, for that purpose, to any convenient part of the carriage.

FLEXIBLE HARROW.—Charles Lane and Jesse M. Healy, Jamestown, N. Y.—This invention relates to a new harrow, which is composed of parallel bars, connected by means of jointed bolts so as to produce a flexible harrow which will adapt itself to uneven ground much better than a solid or stiff harrow, and which will be easier handled, and occupy less room, when packed away, than the ordinary harrows now in use.

TOILET MIRROR.—L. H. Rogers, Boston, Mass.—This invention relates to a new toilet mirror of that class, in which a portion can be swung out to reflect into the main mirror the reverse of the figure placed between the two, and the invention consists in a novel manner of connecting the main with the reflecting mirror, whereby the latter can be swung any desired distance from the main mirror, and turned in any desired direction, or placed above the main mirror, as may be required.

DOUBLE COOLER.—Judson Van Duzer, Otisville, N. Y.—This invention relates to a new cooler which can be used for two kinds of liquids at once, so that, for example, beer and water, or any other two kinds of liquor can, at the same time, be cooled therein. The invention consists in arranging around the main cylindrical ice and water receptacle, and within the outer shell, an annuler vessel, which is to contain the second kind of liquid, so as to keep it cool and fresh.

POTATO MASHER.—William Zeiger, Elmore, Ohio.—This invention relates to a new device for mashing boiled potatoes, so that the same will be thoroughly and properly transformed into a pasty substance without any difficulty or inconvenience. The apparatus is a cylindrical shell, with a hopper-shaped upper end; a grinder is arranged within the cylinder, carrying cutters in the hopper, stationary cutters being arranged in the latter. As the cylinder is turned, the potatoes will be cut into small pieces in the upper, and ground or mashed in the lower part of the vessel, so as to be discharged through a proper spout in the desired state. The stationary cutters are made removable, so that the whole apparatus can be taken apart for cleaning purposes.

TEA-POT.—C. H. Reynolds and George Z. Clark, Croton Falls, N. Y.—The object of this invention is to provide means for removing the leaves of tea from the entrance to the spout of the teapot, and it consists in arranging a spring scraper in the inside of the pot.

LIFTING JACK.—James Dampman, Lebanon, Pa.—This invention has for its object to furnish a simple, convenient, and effective lifting jack, by means of which weights may be quickly ahd readily raised, and held till secured or made ready to be again lowered to their places.

TRACE CARRIER.—James H. Harris, Vermont, Ill.—This invention relates to an attachment to harnesses for holding and carrying the traces or tugs when the team is detached from the wagon or carriage, and consists in a ring, which, in connection with a plate and hooks, forms a portion of the harness fastening.

CHURN.—William M. Rumrill, Roanoke, Ind.—This invention has for its object to furnish an improved churn dasher, which shall be so constructed and arranged as to bring the butter quicker and in greater quantities than in ordinary churns, and at the same time gathering it as it is developed from the cream.

THILL SHIFTER.—S. Jennings, Patterson, N. Y.—This invention has for its object to furnish an improved means of connecting the thills to the sleigh, which shall be strong, durable, and simple in construction, and at the same time so constructed that the thills may be shifted from a side to a central draft, or the contrary, with one hand, while the horse is attached or even while he is in motion.

COTTON PRESS.—C. W. Millerd, Monticello, Ark.—The object of this invention is to provide a simple, effective, and easily operated press for baling cotton and other analogous matter for which it may be found applicable.

FORMER FOR MAKING UPHOLSTERING CONE SPRINGS.—William A. Goodale, Colton, N. Y.—This invention has for its object to furnish an improved machine for forming or turning upholstering cone springs, which shall be simple in construction and effective in operation, forming the springs quickly and accurately.

BUNG CUTTER.—Benjamin and Frederick Geyler, Cincinnati, Ohio.—This invention relates to improvements in cutter heads, whereby they may be readily adjusted to cut them of any desired size, and the cutting tools may be fed up to the work with facility.

WELT KNIFE.—M. J. Ferren, Stoneham, Mass.—This invention relates to improvements in welt knives designed to provide an adjustable cutter which may be changed in its position, as may be required, and also be readily removed for sharpening or other purposes.

KNITTING MACHINE.—Wm. Franz and Wm. Pope, Christline, Ohio.—This invention relates to improvements in knitting machines, by which it is designed to provide a convenient and simple arrangement whereby a part of the needles of a rotary knitting machine may be thrown out of action to admit of narrowing and widening for forming the heels and toes of stockings, or for knitting other flat fabrics or fabrics in strips, also an improved method of forming the heels and toes of stockings.

FASTENING FOR OPEN HORSE COLLARS.—Mr. John A. Meyer, Dutch Creek, Washington Co., Iowa, has invented a simple device for strengthing, keeping in form and place, and fastening horse collars. It is a tempered steel spring encircling the collar, to be placed either inside the collar rim, or on the outside in the hames. The upper ends of the spring are formed into hooks for the reception of a strap or link when the collar is in use. The collar can thus be fastened or unfastened instantly, without the use of strap and buckle, and when the collar is removed the spring keeps it in shape, preventing the liability to break. It may be applied to collars now in use and can be made by any ordinary blacksmith. Its cost is slight, but its advantages great. Those interested may address the patentee as above.

EXTENSION TABLE.—Lambert Freeman, New York city.—This invention has for its object to furnish a simple and convenient extension table which shall be so constructed that it may be extended much or little, as may be desired, and which will be firmly supported however much it may be extended, and whether extended at one or both ends.

GATE.—E. J. Wolfgang and J. W. Kenreigh, Salem, Ohio.—This invention has for its object to furnish a simple and convenient gate, which shall be so constructed and arranged that it may be easily and readily opened and closed by those passing through, without being necessary for them to get out of the carriage.

REELS FOR HARVESTERS.—J. R. Jones, Clarksville, Iowa.—This invention relates to improvements in reels for harvesters, and consists in an arrangement whereby the beaters may be readily changed from one position to another for acting on the grain to straighten it or incline it to the right direction, when it leans in any direction tending to make it cut disadvantageously.

FLOUR SIFTER.—James Coyle, Boston, Mass.—This invention relates to improvements in flour sifting apparatus, such as are used for sifting and pulverizing the flour previous to cooking.

PRINTERS' GALLEY.—Edwin Hutchins, Hartford, Conn.—This invention relates to improvements in printers' galleys, and consists in providing a rest for the same, whereby the bottom thereof will be presented to, and maintained in the same plane with the top of the table to receive the type.

GRAIN BINDING MACHINE.—G. B. Shafer, Delta, Ohio.—This invention relates to improvements in grain-binding attachments for reaping machines, whereby it is designed to provide an attachment, the moving parts of which may be operated from the driving gear of the reaper, to bind up the bundles of grain as they are delivered to it, and discharge them when so bound.

CORN PLANTER.—Daniel P. Leach, Franklin, Ind.—This invention has for its object to furnish a simple, cheap, effective, and accurate corn planter, which shall be so constructed and arranged that it may be easily adjusted to do its work, as the circumstances of the case may require.

NEW PUBLICATIONS.

PLANCHETTE; OR THE DESPAIR OF SCIENCE. Being a full Account of Modern Spiritualism, its Phenomena, and the various Theories regarding it. With a Survey of French Spiritualism. Boston: Roberts Brothers.

This, as its title tells, is a book devoted to the peculiar manifestations of present and past times, which have been called witchcraft, second sight, inspiration, possession, spirit manifestations, etc., etc. It contains an array of facts, the most inexplicable of any that have ever presented themselves to scientific investigation, with the opinions of various writers and thinkers upon the subject.

HOW TO READ CHARACTER. A new Illustrated Hand-Book of Phrenology and Physiognomy, for Students and Examiners, with a Descriptive Chart. New York: S. R. Wells, publisher, 389 Broadway.

TREATISE ON THE POWER OF WATER AS APPLIED TO DRIVE FLOUR MILLS, AND TO GIVE MOTION TO TURBINES AND OTHER HYDROSTALIC ENGINES. By Joseph Glynn, F.R.S., Member of the Institute of Civil Engineers of London. Third edition. Revised and Enlarged with numerous Illustrations. New York: D. Van Nostrand.

This is an eminently practical and useful little book to every one that needs any information upon the subject of which it treats.

HANS BREITMANN'S PARTY. With other Ballads. By Chas. G. Leland.

A volume of these droll and sprightly laughter-provoking poems has been issued on heavy tinted paper, by T. B. Peterson & Brothers, Philadelphia. Price, seventy-five cents.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING MARCH 23, 1869.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On each caveat	$10
On filing each application for a Patent (seventeen years)	$15
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In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

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A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from .... $1 *upward, but usually at the price above named.*

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88,002.—MANUFACTURE OF SHEET IRON.—George Atkins (assignor to George W. Westerman, Robert Fox, and Robert May), Sharon, Pa.

88,003.—MANUFACTURE OF BREECH-PLATES FOR GUNS.—Walter Baker, Ilion, N. Y.

88,004.—BREWING.—Edward Beanes, Cordwalles (near Maidenhead), Great Britain.

88,005.—AUTOMATIC BOILER FEEDER.—Julius Boden, Columbia, Pa.

88,006.—ELECTRO-HEATING APPARATUS.—W. Leigh Burton, Richmond, Va. Antedated March 12, 1869.

88,007.—FIFTH-WHEEL FOR VEHICLES.—E. G. Cameron, Tiffin, Ohio.

88,008.—VALVE FOR BOTTOMS OF VESSELS.—Luther S. Chase and Zebina H. Chase, New Bedford, Mass.; said L. S. Chase assigns his right to Z. H. Chase.

88,009.—HAY RAKER AND LOADER.—Robert Chestnut (assignor to himself and George Kelley), Richmond, Ind.

88,010.—TRIPPING MECHANICAL DETENTS.—Stephen Chester, New York city, and Charles T. Chester, Englewood, N. J. Antedated March 4, 1869.

88,011.—COOKING STOVE.—Orson E. Clark, Waterford, Mich.

88,012.—PROJECTILE.—Wm. A. Cobb, Orange, Mass.

88,013.—OAR.—Henry W. Connor, Troy, N. Y.

88,014.—FLOUR SIFTER.—James Coyle, Boston, Mass.

88,015.—LIFTING JACK.—James Dampman, Lebanon, Pa.

88,016.—APPARATUS FOR BUTTER MAKING.—Frederick P. Denel, Tecumseh, Mich.

88,017.—WRENCH.—L. R. Dexter, Whitefield, N. H.

88,018.—ROAD SCRAPER.—E. L. Dorsey, Winslow, Ind.

88,019.—ROLLER FOR EXTRACTING COCKLE FROM WHEAT.—Wm. G. Douglas, Warrenton, Va.

88,020.—MOLD FOR CASTING PIPE.—Jacob Edson, Boston, Mass.

88,021.—BRIDLE BIT.—Alfred B. Ely, Newton, Mass.

88,022.—BOOK HOLDER.—Freeman Emmons, Danvers, Mass.

88,023.—STRAW CUTTER.—Samuel F. Estell, Richmond, Ind.

88,024.—WELT KNIFE.—Myron J. Ferren, Stoneham, Mass.

88,025.—CULTIVATOR PLOW.—Simeon B. Forbes, Steubenville, Ohio.

88,026.—MACKEREL LATCH.—Charles S. H. Foster, Deer Isle, Me.

88,027.—KNITTING MACHINE.—William Franz and William Pope, Crestline, Ohio.

88,028.—EXTENSION TABLE.—Lambert Freeman, New York city.

88,029.—LAST MACHINE.—Roscoe R. Frohock, Boston, Mass.

88,030.—BUNG CUTTER.—Benjamin Geyler and Frederick Geyler, Cincinnati, Ohio.

88,031.—MAKING CONE SPRINGS.—William H. Goodale, Colton, N. Y.

88,032.—FAUCET.—Daniel W. Green (assignor to William Brundage), Port Chester, N. Y.

88,033.—CIGAR AND CIGARETTE.—Thomas Griffin, Roxbury, Mass.

88,034.—CULTIVATOR.—Anthony Grohmann, South Saginaw, Mich.

88,035.—MACHINE FOR CONSTRUCTING VEGETABLE MEMBRANE.—Stuart Gwynn, New York city.

88,036.—Vegetable Membrane, or Parchment.—Stuart Gwynn, New York city.

88,037.—Slate-punching and Cutting Machine.—L. M. Ham, Boston, Mass.

88,038.—Trace Carrier.—J. H. Harris, Vermont, Ill.

88,039.—Sewing Machine.—M. C. Hawkins (assignor to himself and A. Z. Waters), Edinborough, Pa.

88,040.—Mechanical Movement.—Henry R. Huling (assignor to himself and John M. Marston), Boston, Mass. Antedated March 10, 1869.

88,041.—Printers' Galley.—Edwin Hutchings, Hartford, Conn.

88,042.—Thill Shifter.—S. Jennings, Patterson, N.Y.

88,043.—Harvester Reel.—J. R. Jones, Clarksville, Iowa.

88,044.—Fly Trap.—John H. Kiplinger and Joseph Kiplinger, North Manchester, Ind.

88,045.—Cultivator.—Henry Landes, Bath, Pa.

88,046.—Harrow.—Charles Lane and Jesse M. Healy, Jamestown, N.Y.

88,047.—Hygieometer. — Benjamin M. Lawrence, Galesburg, Ill.

88,048.—Corn Planter.—Daniel P. Leach, Franklin, Ind.

88,049.—Sash-fastening and Hoisting Device.—A. W. Livingstone, Bluffton, Ind.

88,050.—Boot.—John H. Livingston, Providence, R. I.

88,051.—Hoe.—James F. Lowe, Louisville, Ky.

88,052.—Paddle Wheel.—William R. Manley (assignor to himself and Wm. H. Webb), New York city.

88,053.—Chamfering Machine.—Benj. F. Mattox and Sidney Corson, West Ridge, Ill.

88,054.—Portable Bath Tub.—Robert McCully, Philadelphia, Pa.

88,055.—Railroad Car Heater.—F. McManus, Ellenburg Center, N. Y.

88,056.—Churn.—Charles Messenger, Cleveland, Ohio. Antedated March, 9, 1869.

88,057.—Combined Coat Hook and Line Holder.—Wm. A. Middleton, Harrisburg, Pa. Antedated March 12, 1869.

88,058.—Bee Feeder.—Peter Miller, Jr., Fredonia, N. Y.

88,059.—Cotton Press.—C. W. Millerd, Monticello, Ark.

88,060.—Pencil Holder.—J. L. Moore, Bridgeport, Conn.

88,061.—Apparatus for Transmitting Rotary Motion.—Samuel Rodman Morgan, Philadelphia, Pa. Antedated March 18, 1869.

88,062.—Automatic Fan.—John Naugle, Mooresville, Ind.

88,063.—Device for Turning Logs in Mills.—Isaac H. Newton, Grand Rapids, Mich. Antedated March 10, 1869.

88,064.—Process of Preparing Fish for Food.—Joseph Nickerson, Boothbay, Me.

88,065.—Hand-spinning Machine.—Francis M. Nixon (assignor to himself, William Leet, William Dixon, and Jacob S. Best), Lena, Ill.

88,066.—Glass Furnace.—Samuel Oakman, Boston, Mass.

88,067.—Horse Hay Fork.—Oscar Paddock, Watertown, N.Y.

88,068.—Money Drawer.—Carlos L. Page, Cambridge, Mass.

88,069.—Water Elevator.—C. D. Palmiter (assignor to himself and Lavinia P. Webb), Oswego, N. Y.

88,070.—Spring Bed-Bottom.—Byron Partello, Detroit, Mich.

88,071.—Fruit Gatherer.—Hiram Perry, Manlius, N. Y.

88,072.—Crucible for Melting Metals.—Edw'd R. Playle, Great Bend, Pa.

88,073.—Case for Melodeons, etc.—Geo. Sanford Randall, Providence, R. I. Antedated Sept. 23, 1868.

88,074.—Grape Trellis.—Alvin Rathbun, Smith's Mills, N.Y.

88,075.— Composition for Kindling Fires. — Abraham Reed, Louisville, Ky.

88,076.—Teapot.—C. H. Reynolds and Geo. Z. Clark, Croton Falls, N. Y.

88,077.—Toilet Mirror.—L. H. Rogers (assignor to himself, and George A. Rogers), Boston, Mass.

88,078.—Churn.—William M. Rumrill, Roanoke, Ind.

88,079.—Apparatus for Generating Gas, and Heating Dwellings and other Buildings.—S. C. Salisbury, New York city.

88,080.—Furnace for Upright Steam-Generators.—Silas C. Salisbury, New York city.

88,081.—Furnace for Horizontal Steam Generators.—S. C. Salisbury, New York city.

88,082.—Reverberatory Furnace.—S. C. Salisbury, New York city.

88,083.—Blast, Smelting, and Cupola-Furnaces.—Silas C. Salisbury, New York city.

88,084.—Furnace for Heating and Annealing Steel Ingots, etc.—S. C. Salisbury, New York city.

88,085.—Telegraph Apparatus.—John. E. Selden, Albany, N. Y.

88,086.—Mode of Polishing Hard Rubber and other Articles.—W. F. Semple, and R. W. Stephens, Mount Vernon, Ohio.

88,087.—Grain Binder.—G. B. Shafer, Delta, Ohio.

88,088.—Potato Digger.—Isaiah Shaw, Four Corners, Md.

88,089.—Washing Machine.—John P. Simmons, Schoolcraft, Mich. Antedated March 18, 1869.

88,090.—Suspended Portable Fence.—Alonzo Skinner, Warren, assignor to L. A. Skinner, West Novi, Mich.

88,091.—Knife Head for Harvesters.—H. A. Soliday, Doylestown, Ohio.

88,092.—Machine for Hackling Corn Husks.—George B. Stacy, Richmond, Va.

88,093.—Apparatus for Turning Logs.—L. J. Stannard and M. L. Perry, Newark, N. Y.

88,094.—Rule Clamp.—D. H. Stephens, Riverton, Conn.

88,095.—Churn.—J. H. Stephens, Orange Court House, Va.

88,096.—Milk Cooler.—J. C. Thayer, Dunton, Ill.

88,097.—Clothes Pin.—Chas. N. Tyler, New York city.

88,098.—Double Cooler.—Judson Van Duzer, Otisville, N.Y.

88,099.—Button.—W. W. Wade, Medford, Mass. Antedated March 5, 1869.

88,100.—Manufacture of Chains.—Wm. B. Wadsworth, Cleveland, Ohio. Antedated March 8, 1869.

88,101.—Cancelled.

88,102.—Manufacture of Paper.—Z. C. Warren (assignor to H. C. Hulbert), Brooklyn, N. Y.

88,103.—Steam Trap.—Jos. E. Watts, Lawrence, Mass.

88,104.—Conduit for Invalid Chairs.—Geo. Wells, Bethel, Conn. Antedated March 11, 1869.

88,105.—Show Bottle.—Henry Whitney, East Cambridge, Mass.

88,106.—Alarm Bell.—Chas. Wiley, Hannibal Center, N. Y.

88,107.—Hat.—David Wilcox (assignor to himself, W. H. Slocum, and W. A. Brown), Boston, Mass.

88,108.—Gate.—E. J. Wolfgang and J. M. Kenreigh, Salem, Ohio.

88,109.—Plane Guide.—John Woodville, Cincinnati, Ohio.

88,110.—Clothes Wringer.—John Young, Amsterdam, N.Y.

88,111.—Potato Masher.—Wm. Zeiger, Elmore, Ohio.

88,112.—Cooking Stove.—J. J. Anderson, Rochester Pa.

88,113.—Door Key.—Wm. H. Andrews (assignor to Burton Mallory), New Haven, Conn.

88,114.—Gig Saw.—Isaiah B. Arthur, Sidonsburg, Pa.

88,115.—Milking Stool.—Ira Barrows, Hermon, N. Y.

88,116.—Hat.—J. P. Beatty, Norwalk, Conn. Antedated Feb. 2, 1869.

88,117.—Spring.—E. U. Benedict, Chicago, Ill.

88,118.—Coop for Poultry.—S. S. Bent, Port Chester, N. Y. Antedated March 22, 1869.

88,119.—Machine for Cleaning Stables.—D. S. Bigler, and Wm. N. McCracken, Monaghan township, Pa.

88,120.—Velocipede.—John B. Blair, Philadelphia, Pa.

88,121.—Auxiliary Table.—Jas. Blake (assignor to Blake and Company), Scranton, Pa.

88,122.—Butt Hinge.—Etienne Boileau and Chas. Mesnier, St. Louis, Mo.

88,123.—Clothes Dryer.—R. H. Boughner, East Germantown, Ind.

88,124.—Elevating and Weighing Apparatus.—James H. Brookmire, St. Louis, Mo.

88,125.—Blacksmiths' Swage.—G. W. Brown (assignor to himself and A. T. Gifford), Providence, R. I.

88,126.—Meat Chopper.—C. N. Brumm, Minersville, Pa.

88,127.—Hay Rake.—R. I. Burbank, Boston, Mass.

88,128.—Blacking Box.—Richard Cadle, Shawneetown, Ill.

88,129.—Sash Lock and Bolt.—L. O. Cameron, Allegheny City, Pa.

88,130.—Car Coupling.—Richard Campion and J. W. Thomson, Jr., Camden, N. J.

88,131.—Boot.—M. F. Chandler, Boston, Mass.

88,132.—Extension Table.—Giacomo Chelini, Washington, D. C.

88,133.—Knob Latch.—A. B. Clemons, Ansonia, Conn.

88,134.—Medicine for Cure of Ring Bone, Spavin, etc.—W. A. Cleveland, Waterville, N. Y.

88,135.—Plastering Machine.—J. L. Coburn, Mineral Point, Wis.

88,136.—Cultivator.—Alex. Connolley, Milan, Ind.

88,137.—Bolt Feeder.—Jacob Cornwell (assignor to himself, D. B. Merrill, and W. H. McCourtie), Kalamazoo, Mich.

88,138.—Scoop.—Wm. Craine, South Brookfield, N. Y.

88,139.—Composition Pavement.—J. P. Cranford, Brooklyn, N. Y.

88,140.—Lamp for Destoying Insects.—Geo. C. Cranston, South Bend, Ind.

88,141.—Piles.—S. B. Cushing, Providence, R. I.

88,142.—Tempering Steel Springs.—Joseph H. Deniger, Bridgeport, Conn

88,143.—Cutter for Tonguing and Grooving.—D. C. Devall, New York city, assignor to J. B. Schenck, Matteawan, N. Y.

88,144.—Clover Harvester.—Paul Dismukes, Gallatin, Tenn.

88,145.—Blind Wiring Machine.—W. F. Dodge, Newark, N. J.

88,146.—Sofa Bedstead.—Jacob Dourson, Columbus, Ohio.

88,147.—Flood Fence.—Zachariah Dowden and C. T. Anderson, Clarksburg, Md.

88,148.—Churn.—S. D. Edgar, Dayton, Ohio.

88,149.—Adjustable Pole Attachment for Carriages.—H. F. Edwards (assignor to himself and B. I. Peabody) Worcester, Mass.

88,150.—Mop Head.—John Fahrney, Boonsborough, Md.

88,151.—Velocipede.—H. J. Ferguson, Whiting, N. J.

88,152.—Shutter Fastening.—W. C. Fisher, Charlestown, Mass.

88,153.—Spring Bed Bottom.—Mark Flanigan, Detroit, Mich.

88,154.—Railway Car Wheel.—A. C. Fletcher, New York city.

88,155.—Car Spring.—A. C. Fletcher, New York city.

88,156.—Harvester Rake.—J. S. Fowler, Davenport, Iowa.

88,157.—Beehive.—J. J. Frey and A. J. Frey, Hook's Point, Iowa.

88,158.—Folding Bedstead.—M. B. Goodell, Worcester, Mass.

88,159.—Holdback.—D. A. Gorham, Norway, Me.

88,160.—Water Reservoir for Cooking Stoves.—C. O. Greene, Troy, N. Y.

88,161.—Breech-Loading Firearm.—J. D. Greene, Cambridge, Mass.

88,162.—Rotating Oscillating Steam Valve.—C. F. Hadley, Chicopee, Mass., assignor to Clifford Arrick, St. Clairsville, Ohio.

88,163.—Device for Converting Rotary into Reciprocating Rectilinear Motion.—C. F. Hadley, Chicopee, Mass., assignor to C. Arrick.

88,164.—Sash Holder.—J. W. Hansel, Peoria, Ill.

88,165.—Paper Box.—A. B. Hendryx, Ansonia, Conn.

88,166.—Clay Molding Machine.—Robert Hill, St. Louis, Mo.

88,167.—Knife Scourer and Sharpener.—Daniel Hodgkins, Newburyport, Mass.

88,168.—Automatic Boiler Feeder.—John Holtz, Baltitimore, Md.

88,169.—Paper Sizing.—J. E. Hover, Philadelphia, Pa.

88,170.—Steering Apparatus.—P. H. Jackson, New York city.

88,171.—Powder for Blasting and other Purposes.—W. H. Jackson, Salem, Mass., assignor to G. B. Upton, D. D. Stackpole, and S. H. Gookin.

88,172.—Shears.—P. N. Jacobus, Flatbrookville, N. J.

88,173.—Manufacture of Iron and Steel.—Jacob Jameson, Philadelphia, Pa.

88,174.—Toy Hoop.—C. C. Johnson, Springfield, Vt.

88,175.—Clothes-Line Fastener.—Job Johnson, S. J. Smith, and Simon Ingersoll, Brooklyn, N. Y., assignors to Job Johnson and S.J. Smith.

88,176.—Saw Gummer.—Nelson Johnson, Jasper, N. Y.

88,177.—Saw Swage.—Nelson Johnson, Jasper, N. Y.

88,178.—Locomotive Drive Wheel.—W. J. Johnson, New Orleans, La.

88,179.—Cord Tightener for Curtain Fixtures.—H. L. Judd, Brooklyn, N. Y.

88,180.—Block for Holding Stereotype Plates.—A. N. Kellogg, Chicago, Ill.

88,181.—Bridge.—J. J. Kelly, Slippery Rock, Pa.

88,182.—Process of Manufacturing Sheet Iron.—T. K. Bolton, Cleveland, Ohio, executor of S. H. Kimball, deceased.

88,183.—Railroad Car Heater.—G. S. Koontz, Washington, D. C., and Edward Potts and McLeod D. Lewis, Baltimore, Md.

88,184.—Centrifugal Draining Machine.—H. W. Lafferty and Robert Lafferty, Gloucester City, N. J.

88,185.—Centrifugal Sugar-Draining Machine.—H. W. Lafferty and Robert Lafferty, Gloucester City, N. J.

88,186.—Door Button.—Thomas Lincoln and Geo. Hubbard, New Haven, Conn.

88,187.—Tellurium.—Marshal Long, New York city.

88,188.—Carpet-Cleaning Machine.—Theodor Luke, St. Louis, Mo.

88,189.—Car Coupling.—I. V. Lynn and W. J. Lynn (assignors to themselves, J. J. McCormick, and W. D. Baker), Pittsburgh, Pa.

88,190.—Construction of Refrigerators.—L. H. Mace and F. S. Gwyer, New York city.

88,191.—Metallic Cartridge.—Edwin Martin, Springfield, Mass., assignor to himself, S. W. Porter, and J. F. Cranston.

88,192.—Breast Strap Slide.—John H. Martin, Columbus, Ohio.

88,193.—Wash Boiler.—A. McDaniel, Dubuque, Iowa.

88,194.—Street Sweeper.—J. W. McDonald, Chicago, Ill.

88,195.—Harrow.—Samuel Mendenhall, Muncy Station, Pa.

88,196.—Fifth Wheel.—Wm. Munson, Abington, Pa.

88,197.—Walking Doll.—A. W. Nicholson, Brooklyn, N. Y.

88,198.—Velocipede.—W. L. Paine, Boston, Mass.

88,199.—Potato Digger. — Chester Palmer, Willoughby, Ohio.

88,200.—Roller Stop for Window Shades.—I. E. Palmer, Hackensack, N. J.

88,201.—Washing Machine.—F. D. Paradis, Chicago, Ill.

88,202.—Cartridge.—W. F. Parker, Meriden, Conn.

88,203.—Self-Registering Lumber Measure.—D. E. Pease and George Richards, Richland Center, Wis.

88,204.—Operating Valves of Steam Engines.—Hart F. Pease, Brooklyn, N. Y. Antedated March 15, 1869.

88,205.—Velocipede.—R. H. Plass, New York city.

88,206.—Lamp-Shade Holder.—J. T. Pope, New York city.

88,207.—Construction of Railway Wheels.—James Rae, London, England, and George Miller, Glasgow, Scotland.

88,208.—Manufacture of Iron and Steel.—John Ralston, A. L. Thomas, and Wm. Parkinson, Tamaqua, Pa.

88,209.—Harvester.—Amos Rank, Salem, Ohio.

88,210.—Nerving Bridle.—J. V. Reardon, Elkton, Md. Antedated March 11, 1869.

88,211.—Sheep Rack.—Shelby Reed, Scottsville, N. Y.

88,212.—Chalk Line Spool.—J. E. Richardson, Lowell, Mich. Antedated March 18, 1869.

88,213.—Grate for Cooking Stove.—J. H. Roelker, Evansville, Ind.

88,214.—Bolt-Heading Machine.—John Root (assignor to himself and McLagon and Stevens), New Haven, Conn.

88,215.—Meter.—S. P. Ruggles, Boston, assignor to J. H. Shedd, Waltham, Mass.

88,216.—Crushing and Grinding Machine.—J. W. Rutter, St. Louis, Mo.

88,217.—Clutch for Slaughtering Purposes.—Richard Savage, Chicago, Ill.

88,218.—Apparatus for Evaporating Medicines in Treating Diseases.—E. O. Schartan, Philadelphia, Pa.

88,219.—Sink.—Wm. Seaman and G. A. Banta, New York city, assignors to Wm. Seaman.

88,220.—Water Closet.—J. H. Seymour, Hagerstown, Md.

88,221.—Water Meter.—Gerard Sickels, Boston, Mass.

88,222.—Apparatus and Process for Extracting Oil from Vegetable and other Matter.—Thomas Sim and E. S. Hutchinson, Baltimore, Md.

88,223.—Fertilizer.—Amor Smith, Baltimore, Md.

88,224.—Compound for Coloring the Hair.—Gibson Smith, Croton Junction, Mass.

88,225.—Harrow.—James Snowdin, Westford, and John Kent, Beaver Dam, Wis.

88,226.—Churn Dasher.—Orville Sperry and J. W. Hopson, Hartfield, N. Y.

88,227.—Last Holder for the Manufacture of Boots and Shoes.—M. J. Stein, New York city.

88,228.—Method of Veneering Articles with Pyroxyle.—Leander R. Streeter, Chelsea, assignor to himself and A. B. Ely (trustees), Newton, Mass.

88,229.—Dentists' Flask.—L. R. Streeter, Chelsea, assignor to himself and A. B. Ely (trustees), Newton, Mass.

88,230.—Wrench.—G. C. Taft (assignor to Loring Coes), Worcester, Mass.

88,231.—Wire for Shoe Pegs.—Elmer Townsend, Boston, Mass.

88,232.—Wire for Shoe Pegs.—Elmer Townsend, Boston, Mass.

88,233.—Plow.—A. J. Traver, Lisburn, Pa.

88,234.—Corn Marker.—G. W. Tucker, Eugene, Ill.

88,235.—Beehive.—G. W. Umbaugh, Lima, Ohio.

88,236.—Miter Box.—C. H. Underwood, Dorchester, assignor to J. A. Dupee, Boston, Mass. Antedated March 18, 1869.

88,237.—Cigar Dryer.—Oliver Vallandigham, St. Louis, Mo.

88,238.—Velocipede.—William Van Anden, Poughkeepsie, N. Y.

88,239.—Neck-tie Retainer.—Jas. Varley, Hudson City, N.J. Antedated March 15, 1869.

88,240.—Carriage Axle.—Frederick Volkmann and Augustus Miller, Philadelphia, Pa.

88,241.—Fanning Mill.—W. W. Wait, Richmond, Ind.

88,242.—Axle Box.—Lewis Wakefield, Minneapolis. Minn.

88,243.—Wash Boiler.—Samuel J. Wallace, Keokuk, Iowa.

88,244.—Corn Planter.—J. P. Ware, Montgomery City, Mo.

88,245.—Expanding Chuck.—Wm. Webb, Waterbury, Conn.

88,246.—Automatic Boiler Feeder.—T. B. Webster, Sekaukus, N. J.

88,247.—Roller Cleaner in Spinning Machines.—Horace Wells, Hopkinton. R. I.

88,248.—Automatic Transmitting Telegraph Apparatus.—C. Westbrook, Harrisburg, Pa.

88,249.—Gate.—S. P. Williams, Sheridan, N. Y.

88,250.—Machine for Splitting Wood.—Wm. L. Williams, New York city. Antedated March 18, 1869.

88,251.—Dish and Clothes Washer.—G. W. Williamson, Gouldsborough, Pa.

88,252.—Fence.—J. Q. A. Yonkey and F. M. Rawson, Frankfort, Ind.

88,253.—Combined Sower and Cultivator.—Martin Woodard, Des Moines, Iowa.

88,254.—Harvester.—Geo. W. N. Yost, Corry, Pa.

88,255.—Table Attachment for Chairs.—Wm. Zimmerman, Bloomington, Ill.

88,256.—Artists' Easel.—F. W. Bacon, New York city.

88,257.—Machine for Winding Cloth.—G. F. Hargis, Decatur, Ill.

88,258.—Process of Deriving Useful Products from Garbage, etc.—W. E. Johnson, Chicago, Ill.

88,259.—Liquid Meter.—J. H. Shedd, Waltham, Mass.

88,260.—Composition for Dental Plates.—L. R. Streeter, Chelsea, Mass., assignor to himself and A. B. Ely, trustees.

REISSUES.

23,826.—Dated May 3, 1859; reissue 3,333.—Skate Fastening.—E. H. Barney and John Berry, Springfield, Mass., assignees, by mesne assignments, of John Coe, administrator of the estate of John H. Coe, deceased, and W. B. Sniffin.

78,699.—Dated June 9, 1868; reissue 3,334.—Nail Extractor.—J. V. Bogert, New York city, and J. F. Lowell, Boston, Mass., assignees, by mesne assignments, of James Tyzick.

42,842.—Dated May 24, 1864; reissue 3,335.—Electro-Magnetic Telegraph.—S. F. Day, Ballston Spa, N. Y.

81,799.—Dated Sept. 1, 1868; reissue 3,336.—Sulky Plow.—J. B. Lewis and J. E. Udall, Concord, Ill.

75,319.—Dated March 10, 1868; reissue 3,337.—Cotton-bale Tie.—D. C. Lowber, New York city, and G. L. Laughland, New Orleans, La., assignees, by mesne assignments, of Wm. Trowbridge.

87,123.—Dated Feb. 23, 1869; reissue 3,338.—Manufacture of Illuminating Gas.—Levi Stevens, Washington, D. C.

35,960.—Dated July 22, 1862; reissue 3,339.—Seeding Machine.—G. W. Van Brunt, D. C. Van Brunt, and Hiram Barber, Horicon, Wis., assignees of G. W. Van Brunt.

55,564.—Dated June 12, 1866; reissue 3,340.—Hot-air Furnace.—Allen & Willard, Hartford, Conn., assignees of Edward Webster.

23,721.—Dated April 19, 1859; reissue 868, dated Dec. 20, 1859; reissue 3,341.—Stop Cock.—Erastus Stebbins, Chicopee, Mass.

DESIGNS.

3,404 to 3,407.—Stocking Fabric.—Conyers Button, Philadelphia, Pa. Four Patents.

3,408.—Stove.—J. V. B. Carter, Albany, N. Y.

3,409.—Stove.—Calvin Fulton, Rochester, N. Y.

3,410.—Label.—G. F. Gantz, New York city, assignor to G. F. Gantz & Co.

3,411.—Locket.—George Hartje and Lucien S. Jacquin, New York city.

3,412.—Barn-door Hanger.—J. L. Haven, Cincinnati, Ohio.

3,413.—Chamber Pail.—J. S. Jennings, Brooklyn, E. D., N.Y.

3,414.—Floor Oilcloth Pattern.—C. T. Myer, Bergen, N.J. assignor to E. C. Sampson, New York city.

3,415.—Floor Oilcloth.—C. T. Meyer, Bergen, N. J., assignor to E. C. Sampson, New York city.

3,416.—Carpet Pattern.—V. E. Meyer, Harrison, N. J., assignor to A. Folsom & Sons, Boston, Mass.

3,417 to 3,420.—Carpet Pattern.—E. J. Ney (assignor to Lowell Manufacturing Co.), Lowell, Mass. Four Patents.

3,421 and 3,422.—Bottle Stand or Caster.—Wm. Parkin (assignor to Reed & Barton), Taunton, Mass. Two Patents.

3,423.—Ottoman.—W. H. Reed, New York city.

3,424.—Trade Mark.—R. H. Rice, Newport, R. I.

3,425.—Spoon or Fork Handle. — Geo. Sharp, Philadelphia, Pa.

3,426.—Plates of a Cook's Stove.—Garrettson Smith and Henry Brown (assignors to W. L. McDowell), Philadelphia, Pa.

3,427.—Stove.—Isaac Snider, Jas. Woodruff, and J. M. Woodruff, Salem, Ohio.

3,428.—Body of a Pickle Jar.—S. A. Whitney, Glasborough, N. J.

3,429.—Fork or Spoon Handle.—H. C. Wilcox (assignor to Meriden Britannia Co.), Meriden, Conn.

3,430.—Trade Mark.—Edward Wilhelm (assignor to A. W Fox & Co.), Buffalo, N. Y.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

504.—Machine for Making Sewing Needles.—Francis W. Mallett, New Haven, Conn. Feb. 18, 1869.

531.—Butt Hinge.—James Bidwell, San Francisco, Cal. Feb. 20, 1869.

538.—Floating Velocipede.—J. G. Holbrooke, New York city. Feb 20, 1869.

546.—Manufacture of Iron and Steel.—T. S. Blair, Pittsburgh, Pa Feb. 22, 1869.

548.—Artificial Stone.—Wm. Munroe, Boston, Mass. Feb. 22, 1869.

550.—Velocipede.—L. B. Flanders, Philadelphia, Pa. Feb. 22, 1869.

551.—Screw Wrench.—C. L. Perkins, New York city. Feb. 22, 1869.

561.—Fire Boxes and Ash Pans of Locomotive Engines.—H. L. Lansin and G. H. Chase, Buffalo, N. Y. Feb. 23, 1869.

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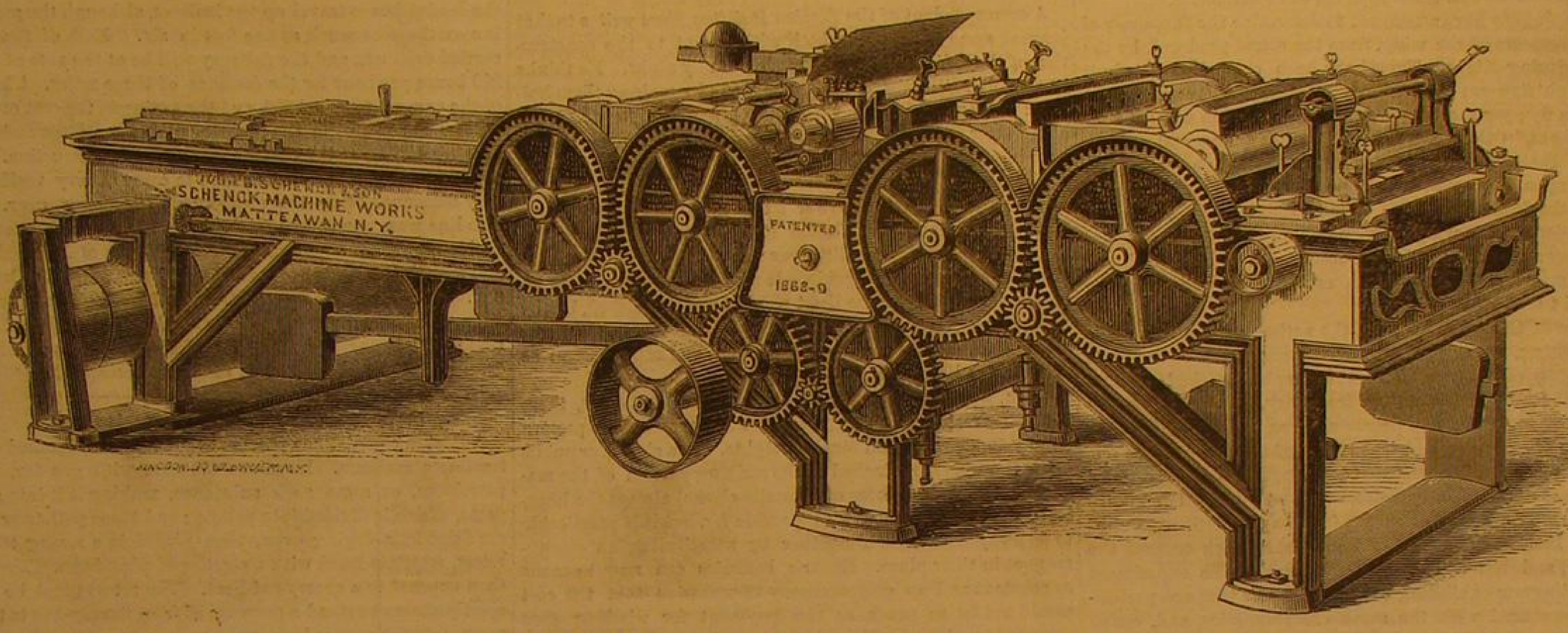
Vol. XX.---No. 16. [NEW SERIES.] NEW YORK, APRIL 17, 1869. $3 per Annum [IN ADVANCE.]

Improved Woodworth Planing Machine.

The Woodworth planer for nearly forty years has been known and used in this country, and has made a name for itself in others. The Woodworth planer occupies the foremost rank among the many labor-saving machines produced by the inventors of the last half century From the experience and skill it has developed, have sprung the molding and tenoning machines, so important among the labor-saving machines used in the building art.



THE IMPROVED SCHENCK-WOODWORTH PLANER.

The Schenck Machine Works, founded in 1832, were the first establishment which made the manufacturing of the Woodworth planer a specialty. The senior of the present proprietors, after an experience of many years in the construction of what has been so long known as the "Schenck-Wood worth planer," has made many valuable improvements in them, for which letters patent have been secured through the agency of the SCIENTIFIC AMERICAN.

The engraving represents their extra No. 1 planer, with eight feed rollers, and an under cutter, so that it planes both sides and matches both edges at one operation.

The improvements made by Mr. Schenck are as follows: A method of adjusting all the top feed rollers simultaneously, preserving their relative positions by means of one crank, by a very simple arrangement, requiring only one screw on each side of the machine; also adjusting the facing cylinder and the pressure bar on the delivering side, as well as the pressure roller on the entering side of it simultaneously, precluding the possibility of lowering the facing cylinder, so as to come in contact with the pressure bar and roller, or of raising the bar and roller so as to come in contact with the knives on the facing cylinder, thus rendering it perfectly safe to adjust the machine so as to receive stuff of any thickness desired while in operation, with no appreciable loss of time.

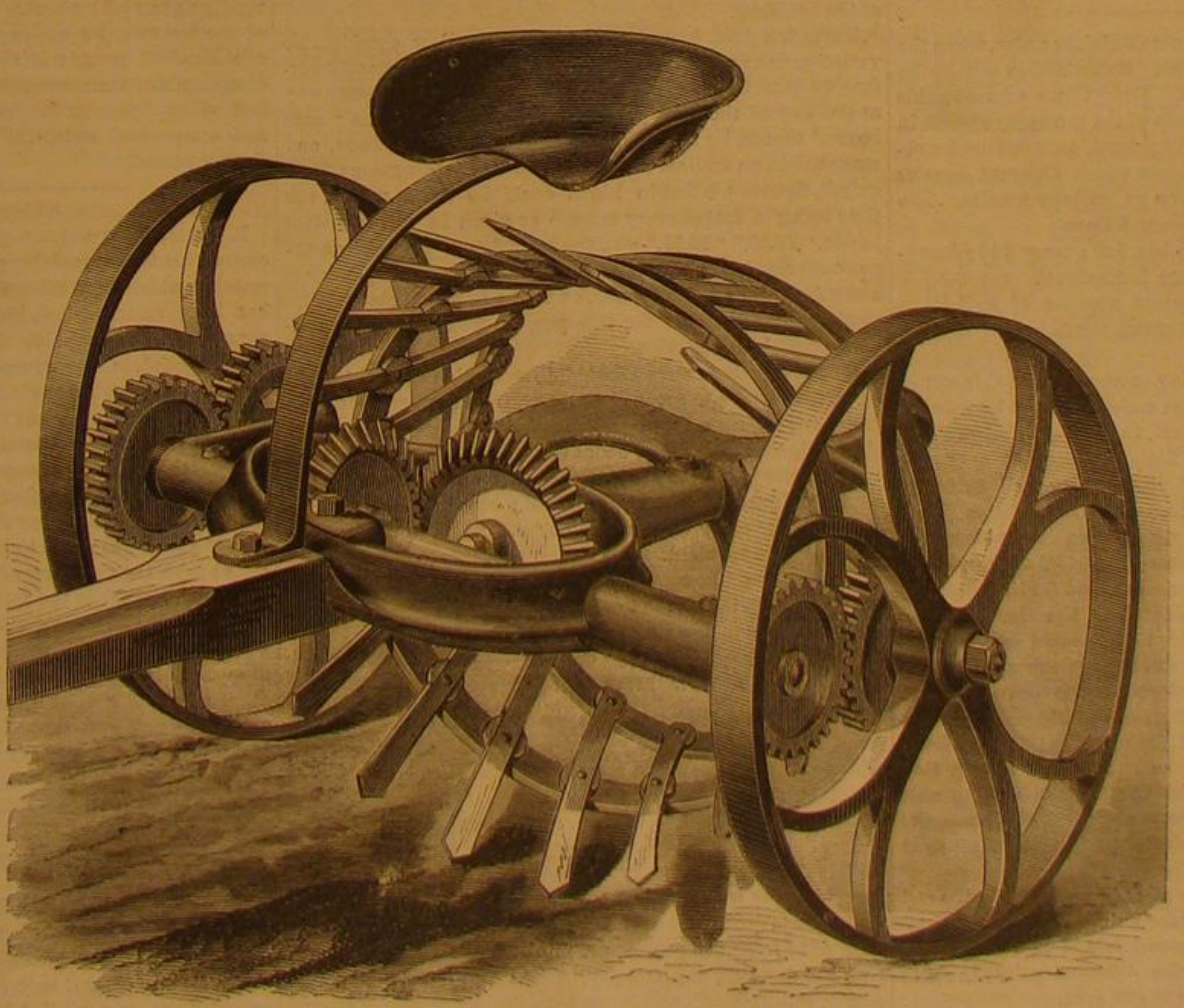
Another important improvement consists in making the lever which weights the introducing pressure roller adjustable, so that it may be placed (as it always should be) over the middle of the board being planed. This causes the roller to bear evenly on the surface of the board, and prevents it from canting. This pressure roller is raised by, and with the introducing feed roller, always being one-eighth of an inch below it, so that the board, in passing under it, raises it only the one-eighth of an inch, whether much or little is to be planed off. The advantages of this arrangement will be apparent to all in the operation of the planing machine. The most important improvement, however, is the arrangement by which the matching guides and matching head are adjustable across the machine, all being moved by one crank, or the shank of the matcher hanger screw shown in the engraving; the guides being moved by the horizontal shaft, which, by means of the bevel gears, revolves the screw which carries the end of the long introducing guide, and simultaneously adjusts the guides and matcher head, preserving their relative positions to any desired point across the machine. By this improvement, the whole length of the knives is used when narrow stuff is being planed on a wide machine, effecting a great saving of knives, also of time, as the change is made while the machine is running, and with no loss of time. The advantages of this improvement are apparent to every operator. It is very simple and durable, and accomplishes the objects for which it was designed, with great accuracy.

The Messrs. Schenck build a great variety of smaller planers—some for surfacing only—but all combining the same principles of simultaneous, adjustment, which are the leading characteristics of the improved Schenck-Woodworth planers. For descriptive circulars, address John B. Schenck & Son, Matteawan, N. Y.

Machine for Digging Potatoes.

The harvesting of that most valuable and popular esculent the potato, is a labor so monotonous and exhausting, that though no one objects to the root, when it appears on the table, in whatever garb, digging potatoes is regarded as quite another thing. So, a machine that will dig the bulb, and save human arms and human endurance the labor, must be acceptable. Such is claimed, by the inventor, to be the machine which the engraving represents.

It is simply a carriage or frame supported on two driving wheels, and is drawn by a team of two horses, walking on each side of the drill or row of hills. Secured to the driving wheels, and revolving with them, are two gears, engaging with two other gears on a front shaft, carrying, at the center of the frame, a bevel gear that meshes with a similar gear on a shaft in line with the draft pole. This shaft turns in a sleeve forming a portion of the frame of the entire machine, and carries, on its rear end, a cylindrically-shaped frame, the rear of which is open, and the sides of which are spirally-arranged tines, pointed and flaring at the front end, and strengthened by hoops or cylindrical bands.



BAKER'S ROTARY POTATO DIGGER.

In operation this basket cylinder revolves, by the draft of the machine over the ground, in a direction with the spiral incline of the bars or tines. The points of these enter the ground to a depth sufficient to lift the roots, this depth being governed by the downward inclination of the tines at their forward or entering end. The forward and rotating movement of the arms of this cylinder, combined with their spiral arrangement, lifts the potatoes from their bed, sifts the clinging soil from them, and deposits them in a regular row. It does not dig the earth as do some other machines intended for the same purpose, but it lifts the tubers, sifts them from the earth, and leaves them clean on the surface of the ground, without plowing. Beside this, it acts somewhat as a plow, cultivator, or harrow, disintegrating the clods, and leaving the soil porous and open for a subsequent crop, or for the action of the frost, preparatory to the next spring's planting. But this preparation of the soil is only secondary to the primary object of the device, which is to lift the potatoes and separate them from the soil. It is intended as a potato digger and not a soil digger.

Letters for information should be ad- dressed to the inventor and patentee, T. Baker, Stillwater, Saratoga county, N. Y.

The Velocity of Insects' Wings During Flight.

The *Comptes Rendus* contains an interesting article, by E. J. Marey, containing the results of an attempt to submit to strict experiment the study of those motions which the eye cannot follow, and the form of which cannot, under ordinary circumstances be discussed, on account of their extreme rapidity. The points to be determined, and the questions to be answered, were:

What is the frequency of the movements of insects' wings? What are the different positions which the wing takes in the different phases of each of its revolutions? By what mechanism does the wing, taking the air for its fulcrum, produce the locomotion of insects?

The results attained have a direct bearing upon the construction of flying machines, and will be perused with interest by aeronauts and those aspiring to be aeronauts.

Physiologists have attempted to determine the frequency of the movements of the wing, from the sound produced by the insect during flight. They have been compelled to admit very high figures; six hundred vibrations a second, for the common fly; yet that number must be tripled in cases of very rapid flight. Other insects must produce a far greater number of beats. Naturalists, nevertheless, have been little agreed upon the cause which produces the sound we hear during the flight of insects. Some authors think the sound independent of the wing movements, produced by a special humming apparatus; it is due, according to others, to the alternate movements of the air, in escaping and entering the tracheal tubes.

In face of these discordances, the author sought for a mode of exhibiting, in an unmistakable manner, each of the beats of the wing of an insect, and the graphic method answers very well for determining their frequency.

He grasped, with a fine pair of nippers, the hind part of the abdomen of an insect, and when it sought to fly, directed one of its wings in such a way, that it rubbed by its point against the surface of a smoked cylinder, which revolved with a known velocity. The wing, at each of these revolutions, carried away a little of the black of the smoke which covered the cylinder, and left a trace of its passage. This experiment gives a diagram exhibiting the varied forms that are periodically reproduced with the same characteristics, and, consequently, correspond to one revolution of the wing. By means of a chronographic diapason, the exact number of the revolutions of the wing which are effected in a second were precisely determined. That which he used, gave a graphic delineation of five hundred simple vibrations per second.

A continual rubbing of the wing on the cylinder, presents a resistance to this organ, which retards its frequency; so in order to have the nearest approach to the truth, those drawings were selected in which the contact of the wing with the cylinder was at a minimum, so that the diagrams were reduced to a series of points.

The frequency of the movements diminishes, also, when the wing is loaded with a little weight. It diminishes equally by fatigue, and the action of cold. Everything occurs in this case, as in the rhythmic movements of the muscular system in different animals. Under equally favorable conditions for observation, the frequency of the beats which different species of insects produce, brings before us curious results. The numbers found for each second are as follows:

Common fly, 330; drone, 240; bee, 190; wasp, 110; hawk-moth, 72; dragon fly, 28; cabbage butterfly, 9.

A more complete study of a great number of well-determined species would, doubtless, furnish much higher figures, as the maximum frequency.

It should be added that the wing movements, in this sort of captivity, on account of the greater resistance, will be reduced in number. The above figures must, therefore, be below those representing vibrations in a free flight.

The graphic method does not answer very well to determine the course of the wing at each of its revolutions. The tracings which the point of the wing of an insect describes in space are inscribed on the surface of an ideal sphere, which has for its radius the length of the wing, and for its center the point at which this organ is implanted in the thorax of the insect. A spherical surface of this nature could only be tangential at one point to the surface of the registering cylinder, and every fuller contact risks deforming the drawing more or less, in reproducing the curvature of the wing. To obtain an exact notion of the course of the wing in space, Wheatstone's optical method was employed. It is well known that this celebrated English physicist terminates vibrating rods with bright metallic balls, whose gleam leaves upon the retina persistent impressions of the periodical movements they execute.

By fixing with varnish a little piece of gold leaf to the end of an insect's wing, and placing the animal in a ray of sunlight, a bright luminous image was obtained in the form of the figure 8, which indicates the different points in space traversed at each revolution, by the gilt spot.

Among different sorts of insects the experiments almost always met with the same form.

Resuming then the graphic method to verify this result, he succeeded in obtaining successively portions of the drawing, in some cases giving the upper loop of the 8, in others the lower, and in others the double point, where is the intersection of the two halves of the 8.

By way of further confirmation, he sought to register the ontact of the wing with the cylinder, not only by its point, but by its anterior margin. The theory anticipates that under these conditions the figure 8 ought to disappear, and in its place one should obtain a double contact of the wing with the cylinder. One of these contacts took place at the instant the upper loop of the 8 was formed, and at the point where this loop presents its convexity to the cylinder. The other contact took place where the lower loop was formed under the same conditions.

The author concludes that this complex movement does not result from a series of periodic muscular acts executed by the insect, acts which would produce in one case a simple oscillation in a vertical direction, while in the horizontal direction, other muscles would produce, at the same time, two oscillations. In reality, the insect only executes one movement of lowering the wing, to which succeeds a movement of elevation, and if in consequence of these two contrary movements, the wing is not limited to oscillate in one plane, this results from the resistance of the air, which imposes upon the wing a deviation in each half of its course.

Clocks and Clock Towers.

A correspondent of the *London Building News* writes to that journal some suggestions, both with regard to the construction of clock dials and their illumination by night. He thinks it possible to illuminate the hands alone by making them hollow: in fact, gas tubes with jets of gas close to each other along their entire length, after the manner of lighting to be seen in many places. There would be no difficulty in introducing the gas into the hands, which would by this means be seen as far as the clock tower itself allowed. The figures might be similarly illuminated if considered necessary, but they are really of very little use, the position of the hands alone being a sufficient guide. It may be objected that in an occasional high wind the light would be extinguished, but by having one jet properly protected in the center, the flame would immediately run along the hands, and relight them as often as the light might be extinguished.

Then, with regard to the construction of the towers, there can be no reason why they should all be after one pattern simply to provide room for the weights. In a church or public clock the weights attached to the striking portion of the machinery are (unlike those of domestic clocks) always the heaviest and the most difficult to provide for, but it is practicable to do away with them altogether by substituting an electro-magnet in their place. Electric batteries can now be made so constant and so comparatively inexpensive that the cost would not be so much as the payment for winding often amounts to. The smallest clock in the basement of the tower, or, indeed, in any part of the building, could be made to send the requisite currents both for the "going" and the "striking" parts of the machine. Unsteadiness of the tower would not at all interfere with the performance of the clock.

The suggestion of an oval dial, mooted in a previous issue, is, he thinks, hardly advisable, seeing that it would in effect reduce the diameter of the dial to that of its shorter axis, and as size is tantamount to visibility, the aim is generally to obtain the largest space consistent with the architectural details of the building.

There is a plan, however, which would allow considerable variation in the shape of the dial, and yet, with a smaller surface, be more distinct. It is to show the time in the same way as the day of the week and month are shown in some "date boxes," that is, by the figures being painted on linen, and stretched in an endless coil over rollers. By this means, if required, figures ten feet in hight could be made use of, the time being indicated every minute as given in railway time tables, "12.50," "12.51," etc., the hour figures being in an upper compartment, either immediately over or some distance away from the minute figures, as fancy might dictate. The mechanical apparatus for this purpose would be of the simplest possible description.

If such a scheme were adopted, illumination by night could be effected with the greatest facility. On some portion of the tower gas piping might be arranged, coil within coil, so that all the figures from 1 to 0 should be represented, and then, as each minute passed, by simply turning the proper tap, the requisite figure would be illuminated; one tap being turned on before the other was turned off, the flame would be communicated as required. It is almost needless to observe that the piping could be colored to any required tint to harmonize with the materials of the tower, and, moreover, might be so constructed as to be an ornamental addition.

A New Method of Carriage.

The *London Building News* says an invention of Mr. Hodgson, C.E., was tested lately at Bardon Hill and Markfield, which claims to provide a means for the cheap carriage of minerals, stones, and other substances, far surpassing the cumbrous land carriage system now in use. The inventor claims that, by this system, a way can be constructed very rapidly, that the necessity of leveling the ground, and of bridging over water courses or other obstacles is avoided, and that it costs much less than any other road, varying in price from £250 to £1,000 pounds per mile, to carry from 50 to 1,000 tuns per day over any country, which price includes steam power, rolling stock, and every requisite for work. The cost of transit also is very low, as compared with the expense of carrying on the axle. The system may be briefly defined as a continuous development of the plan now not unusual in India, Australia, and in some mining districts, of bridging over a river or ravine by a single wire, by which, carried in a bucket suspended by a pulley, the necessary loads are transmitted from one point to another. To accomplish (in the words of the inventor) the easy passing of the points of support necessary to carry out a continuous line of communication, and to provide for the distribution of the burden and the application of motive power, have been problems of no small difficulty; but experiments having demonstrated the practicability of this scheme, arrangements were entered into with the proprietors of the Markfield granite quarry.

The line consists of an endless wire rope, supported on a series of pulleys, carried by substantial posts fixed in the form of tripods (varying in hight from 14 feet to 40 feet), which are ordinarily about 150 feet apart, but where necessary much longer spans are taken, in one instance being nearly 600 feet. This rope passes at one of its ends round a drum worked by an ordinary movable steam engine of 16-horse power, and the rope is driven at a speed of about four miles an hour, although when the way is completed six miles and upwards will be attained. The boxes in which the stone is carried are hung on to the rope at the loading end, the attachment consisting of a pendant of groove-like shape, which maintains the load in perfect equilibrium during the whole course of the journey, whether it be traveling up or down the inclines, and at the same time enables it to pass the supporting pulleys freely; and it is a source of wonder to see the ease with which the loaded boxes travel up the inclines, although the gradient is sometimes as much as one foot in six. Each of the boxes carried one cwt., and the delivery will be at the rate of about 200 boxes per hour for the distance of three miles. The cost of the present way is £200, and the saving in the cost of traffic will be 33 per cent to the proprietors, Messrs. Ellis and Everard, in addition to the enormous saving in construction. The scheme is susceptible of extension to carry heavy traffic, the only difference being the providing of stronger gear. The The line was constructed by the Wire Tramway Company, of London, under the personal superintendence of Mr. Hodgson, and with the efficient co-operation and assistance of Mr. Ommanney. The cost of the rope is about 1s. 9d. a foot, and is manufactured at Warrington, being half an inch in diameter. The rent paid to owners of land over which the posts are fixed is 5s. per foot, the whole rent of the course being £25.

Reducing Aluminum from its Ores.

A Boston chemist has patented the following method of extracting aluminum. He mixes alumina with gas tar, resin, petroleum, or some such substance, making it it into a stiff paste, which is divided into pellets; and these pellets or balls are dried in a drying oven, then placed in a strong tube or retort, which is lined with a coating of plumbago. They are then exposed to a cherry-red heat. The retort must be sufficiently strong to stand a pressure of from twenty-five to thirty pounds on the square inch, and be so arranged that, by means of a safety valve or tube, the necessary amount of hydrocarbon gas can be introduced into the retort among the heated mixture, and the pressure of from twenty to thirty pounds on the inch be maintained. Hydrocarbon gas is generated and pumped into the retort, and as it is consumed the supply is maintained. By this process the alumina is reduced and the metallic aluminum remains as a spongy mass, mixed with carbon. This mixture is then remelted with metallic zinc, and when the aluminum has collected in the metallic state, the zinc is driven off by heat. The reduction is due to the action of the hydrocarbon under pressure. The time for reducing one hundred pounds of aluminous earth, cryolite, or other compounds of aluminum, should not be more than four hours; and when hydrocarbon gas can be obtained in a heated and compressed state, the reduction takes place in a still shorter period.

Safety Matches.

It is well known that a great number of serious accidents occur from fire, caused by persons carelessly throwing down matches which they believe to be harmless, because the flame has been extinguished, but which in reality are highly dangerous, and quite capable of communicating fire to any light dry material, in consequence of the wood splint being at a red heat, although not actually in a flame. It has been proposed, in order to prevent this, to saturate the splints (previously to their being dipped), with a solution of any chemical salt which has the property of preventing the wood from remaining at a red heat, after the flame has been extinguished, without being in any way detrimental to the inflammable nature of the splint; and thus to prevent the possibility of accident from the dropping of the match after the extinction of the flame, but while the splint is still at a red heat. The substance which he proposes to employ is alum; though other salts have this same property. The matches before being dipped are to be immersed in a strong solution of alum or other salt with similar action, until they are saturated—they are to be dried and dipped with the ordinary composition. Matches so treated are said to ignite and burn with flame as long, and as readily, as other matches, but the instant the flame is blown out, the match becomes black and perfectly harmless.

Gold Refining.—Mr. F. B. Miller, an assayer of New South Wales, has recently specified a patent which relates to the refining of gold. The title is "*An improved method of toughening British gold bullion, or refining alloyed gold, and separating therefrom any silver it may contain.*" In his specification, the patentee proposes to effect his desirable object by the employment of chlorine gas or hydrochloric acid gas, applied in such a manner that it shall rise up among and through the alloyed gold in a molten condition, by which means the chloride of silver, and the chlorides of any other metals of baser order which may be present, will be formed, and will rise to the surface of the melted mass, while the gold will remain beneath in a purified and tough condition. The author read a paper upon the subject, before the Chemical Society of London, a few months ago.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. III.

During the year 1866, a new kind of blasting powder, which promised to supersede gunpowder in mining operations, was introduced to public notice in England. This was the invention of M. Gustave Adolph Neumeyer, of Taucha, Saxony, and to which the term "inexplosive" may appropriately be applied, inasmuch as there is no possibility of its exploding, either during its manufacture, storage, or manipulation. Not until the proper moment of ignition arrives, when it is well rammed home and prepared to do its work, is its energy developed. Then, and only then, it manifests a power, when used weight for weight, considerably in excess of that possessed by gunpowder. M. Neumeyer, all his life connected with the management of quarries, and himself the possessor of a quarry near Taucha, had his attention forcibly drawn to the distressing accidents, which are of such frequent occurrence in blasting operations, and he conceived the idea of producing a blasting powder which should combine the desired degree of strength, with perfect safety when in work. After a long series of trials and experiments, he succeeded in effecting his object, by the invention of a powder which unites in itself the above important qualities. Within two years from the date of his discovery, M. Neumeyer was manufacturing this powder on a large scale; extensive mills with steam power having been erected for its production in the city of Altenburg, and in two other places in Germany.

Although Neumeyer's powder differs in color as well as in action from gunpowder, in that it is slow burning instead of violently explosive when in contact with air, it is composed of precisely the same materials as ordinary gunpowder. To these no other substances are added, the whole secret of the extraordinary result arising simply from the method of proportioning and compounding the ingredients. A reduction is made in the amount of sulphur employed, by which means a much smaller quantity of the noxious vapors is evolved on its ignition than is produced by the combustion of ordinary gunpowder—a point of great importance in underground mining operations. Some difference is made in its preparation, according to the use for which it is required, whether for military or for mining purposes. As a consequence, there results, in the former case, a powder which, when hermetically confined, explodes at the same temperature as ordinary gunpowder, while when prepared and charged for blasting purposes, it requires a somewhat higher temperature. This, so far from being objectionable, is positively advantageous, inasmuch as it makes the possibility of accidental ignition more remote. Bickford's safety fuse, which is now so extensively used in our own and continental mines, is best adapted for the ignition of this powder. Another important feature in Neumeyer's powder is, that although no coating or glaze is imparted to it in manufacture, it is not more hygrometric than ordinary gunpowder, while, if wetted and dried, it is said to retain all its good qualities in full force. Ordinary powder is more powerful as the size of the grain is increased, but Neumeyer's powder, when in a condition of fine dust, is equally if not more efficient than the other. From what has been said, it will be seen that the new gunpowder embodies safety in manufacture, in transport, and in handling, preparatory to actual use; while it has been proved to be superior to ordinary gunpowder, in point of effective power, so that it may fairly be said to be a safe and efficient substitute for our old powder.

In support of the above assertions, both of its inexplosiveness and explosiveness, the author would observe that he has made some trials, which proved conclusively that Neumeyer's powder possessed both those qualities. But as a greater value attaches to trials made publicly, and the results of which have been placed publicly on record, the author prefers to give these in place of his own limited experience of this powder. First, then, as to its inexplosiveness. This was proved by several experiments made in the grounds of the Crystal Palace in December, 1866. The most conclusive test of this quality of the powder was the following:—A small house, 5ft. square, built of brick and roofed with slate, and having two chimneys made of 5-inch drain pipes, was constructed, and in it 35lbs. of Neumeyer's powder, half blasting and half gunpowder, were placed. On firing this mass an immense body of flame issued through the openings in the roof, but the powder simply burned, and moved neither brick nor slate. On 3lbs. only of ordinary gunpowder being placed in the same structure and ignited, a violent explosion took place, which rendered the building a mere wreck

With regard to its explosiveness, the author has a number of authenticated reports of numerous and varied trials illustrative of this quality. A few are selected which have been made in mines and quarries in England. The first trials to be noticed were made on the 4th of December, 1866, at the Bardon Hill and the Markfield Granite Quarries, situated near Leicester, and owned by Messrs. Ellis and Everard. The rock at Bardon Hill, which is of a very hard and stubborn character, was rent and cracked in a most satisfactory manner, and a large quantity of material was thrown down, the results being considered highly successful. At the Markfield Quarry one hole was bored horizontally at the foot of an unbroken face of a large extent of solid rock; others were bored vertically. On firing the horizontal hole, the face of the rock was blown out to a considerable extent in every direction, and an unusually large amount of stone was displaced. The vertical shots proved equally successful, and the results generally were highly satisfactory, the quantity of the new powder used being less than that of ordinary powder required for the same amount of work. In a hard, compact rock, too, such as at Bardon Hill, the effect produced by a given quantity of the new powder is much greater than that produced by an equal quantity in a soft or loose rock. It may be as well to mention here, that, bulk for bulk, Neumeyer's powder, when well tamped, is equally as strong as if not stronger than ordinary powder; while weight for weight, Neumeyer's powder is the stronger of the two. In point of weight, the new powder is one-sixth lighter than the old, which, supposing we take them at even prices, gives over 15 per cent advantage to the former, owing to the fact that bulk for bulk (or one-sixth less weight) gives an equal, if not a superior result, to the best ordinary power.

Having seen the successful action of the powder upon granite, we will now notice its behavior in slate quarries. On the 11th of December, in the same year, five shots were fired at the quarries of the Welsh Slate Company, Rhiwbryfdir, Carnarvonshire. The first shot was in hard rock, the hole being 2ft. 6in. deep, and 1¼in. in diameter; 21in. of the new powder were used, and found to do more work than the same bulk of ordinary powder. The second shot was fired in a hole of the same diameter as the last, but 3in. deeper, cut in the same description of rock; the same depth of powder was used, the result being similar to that obtained with the first shot. Shot No. 3 was in a hole 3ft. 6in. deep, by 1¼in. in diameter, the material bored being pure slate or pillaring rock; the powder filled the hole within 1in., which was occupied with the tamping. The result of this shot was the discovery that the powder was much too powerful—a fault certainly on the right side, and one easily remedied. The next hole was in the same rock as the last, and was 5ft. 8in. deep, with 4ft. 6in. of powder and a light tamping; this gave exceedingly satisfactory results. In another 1¼-inch hole, 4ft. 6in. deep, 2ft. of powder were used, with 2ft. 6in. of hard tamping; the result of this shot was decidedly good, the rock being shattered. On the following day three more experiments were made at the same quarries. With 2ft. 6in. of powder in a 1¼-inch hole, 3ft. 6in. deep, the shot proved much too strong. The second shot was highly satisfactory; but in the third too much power was again developed

The general result of these experiments is to prove that, bulk for bulk, Neumeyer's powder is much stronger than the powder in ordinary use at these quarries, and which was of the very best description. The question, therefore, arose as to how the strength was to be reduced when pillaring. It was proposed to have paper cartridges of much smaller diameter than the holes, and which would hold only about one-third or one-fourth of the present charge of powder. These cartridges, it was believed, would answer the purpose exceedingly well in the pillaring rock, where it was desirable to cleave the slate without fracture, and would beside produce a very considerable saving of powder.

A few days after the foregoing experiments, a series of trials were made with the new powder at the slate quarries of Messrs. Matthews & Sons, at Festiniog, Merionethshire. Here two holes 2ft. deep, in a hard rock of an underground chamber, each half filled with Neumeyer's powder, and two similar holes in a slate rock, were fired with perfectly satisfactory results. Two more shots in the hard rock of the tunnel were not quite so successful; but it was owned that the tamping had been imperfectly rammed, the man having fired them before they were inspected. The two next shots were stated to have done as much with 11in. of Neumeyer's powder as with 15in. of ordinary powder. In another hole, in very hard rock of the tunnel, the result was completely successful, it being stated that with ordinary powder two holes would have been necessary, or the shot would not have succeeded in effecting the required detachment. A 1¼-inch hole, 8ft. deep in hard rock in the open air, was charged with 4ft. 6in. of powder. This shot was considered very successful, for although not much rock fell, an enormous bulk was loosened, which was readily brought down with a small blast of ordinary powder placed in the rent. Experiments have since been made in various collieries to test the capabilities of this powder in the working of coal, and the results have been exceedingly satisfactory, and have fully borne out the expectations formed. Experiments in the copper mines of Cornwall have also given similar results.

THE EFFECT OF LIGHT ON MINERAL OILS.

Herr Geotowsky, at a recent meeting of the Society for the Advancement of the Manufacture of Mineral Oils, in Halle-on-the-Saal, Prussia, made some remarkable communications on a new property of photogenic hydrocarbon oils, discovered by by him. In exposing various kinds of such oils to the rays of light in glass balloons, he invariably found that the oils absorbed oxygen and converted it into its allotropic condition, ozone. It was found that the air was even ozonized in well-corked vessels, the effect being to some degree also dependent upon the color of the glass. The respective results were marked down after the space of three months. Before enumerating them, it is perhaps appropriate to remark that by "photogen," oil from peat or bituminous coal is meant, which distills between a temperature of 212° and 550° Fah., and is of a specific gravity of from 0·795 to 0·805. The term "solar oil," is given by the Germans to oils having a specific gravity of from 0·830 to 0·835 and distilling above the temperature of 550° Fah. The former is burned in lamps adapted for that object, the latter in Argand or Carcel lamps. The observations of Herr Grotowsky are the following:

1. Photogen and solar oil stored in barrels and cisterns, lined inside with iron, remained free from ozone and burned faultlessly.

2. Photogen and solar oil kept in balloons of white glass, wrapped up in straw, showed traces of ozone but burned well otherwise. Both the color of the oil and that of the cork were were found to be slightly changed.

3. Photogen and solar oil in balloons of white glass, which were painted black, exhibited traces of ozone, but the oils were less changed than in experiment No. 2. The corks were not bleached

4. Solar oil and photogen in unwrapped and white glass balloons, which had been kept outside, gave very strong indications of ozone. They burned very badly, charred the wick, and nearly extinguished the flame, after burning for six or eight hours. The solar oil was turned to a deep yellow, and showed an increase of 0·003 in its specific gravity.

5. Solar oil which had been exposed to the light in unwrapped balloons of green glass, gave also strong indications of ozone, though the wick charred it burned well. The color had been little changed.

6. Solar oil in green balloons, painted black, proved to contain some ozone. It burned, however, perfectly well.

7. Solar oil in green balloons, wrapped in straw, gave indications of traces of ozone; it burned like the former. Color slightly bleached.

8. American kerosene, which had been exposed to the light in white and unwrapped glass balloons, had become strongly ozonized, so much so that it scarcely burned. The originally bluish white oil had assumed a vivid yellow shade of color, and the specific gravity was found to have increased for 0·005.

9. American kerosene, which had been kept in the dark for three months, did not show any ozone and burned perfectly well.

The oils had been exposed from April to July, 1868. Those which had become strongly ozonized smelled otherwise than before, and the corks had become bleached as if attacked by chlorine, while those of the unaltered oils had also remained unchanged.

Though the experimenter favors the opinion that the oxygen of the air, in being absorbed by the oil and converted into ozone, does not effect any chemical change, but remains simply absorbed, it cannot be seen why such oils should deposit carbon when burned. They should, on the contrary, burn better. According to Dr. Ott, of this city, there is only only one case possible by which we may account for the decrease in the illuminating power; it is this: The ozone seizes a part of the hydrogen and forms water therewith, while a higher carbonated oil remains. Vohl, a German chemist, expressed the opinion, years ago, that the depositing of soot is invariably caused by an admixture of carbolic acid. If this is taken for granted, it would have to be admitted that a part of the hydrocarbon is directly oxidized by the ozone. This, however, is impossible, as any chemist will admit who is acquainted with the chemical constitution of carbolic acid. Dr. Adolph Ott gives a ready means for ascertaining whether a photogenic hydrocarbon oil will deteriorate in time or not. This test is based upon the property of nascent chlorine gas to act in the same manner as ozone does, which action, however, takes place in a much shorter space of time. In order then to test the oils, it is prescribed to measure equal quantities, say ten ounces of each. Take as many flasks as you have samples of oil, cover the bottom of each, when flat, to the length of one-tenth of an inch with black oxide of manganese, or take otherwise a corresponding quantity of it. Add now so much of strong muriatic acid as will cover the manganese to twice the hight indicated. Fill, finally, the flasks with the oils, and set them on a heated sand bath or in some other warm place, until the generation of gas ceases. Separate now the oils from the residual manganese, and shake them well with warm water before applying them to the burning test.

India-rubber Soles for Boots and Shoes.

A method of making india-rubber soles for boots, etc., has been patened, and consists in applying to a linen cloth india-rubber dissolved in naphtha, camphine, or other suitable solvent. With this india-rubber solution is mixed whiting, sulphur, litharge, or white lead, calcined magnesia, lampblack, and clay, in the following proportions: Four pounds of rubber, two pounds of whiting, one pound of sulphur, one pound of litharge, one-half pound of magnesia, one-half pound of lampblack, and two pounds of clay. When sufficient of this compound has been applied to the cloth, it is passed between rollers, the surface being sprinkled with French chalk to prevent adhesion. Patterns can be imprinted in this manner by the use of an impression cloth, or the surface can be simply roughened. The sheet should be exposed for three hours and a half to a temperature of 60° Fah. The impression cloth is then removed from the surface of the india-rubber. The cloth on which the india-rubber was first spread can be removed, by moistening it with warm water, naphtha, or camphine. The sheet of prepared rubber can be then cut into any desired forms

India-rubber Tubing.

Ordinary vulcanized india-rubber tubing becomes saturated with gas, which again evaporates at its outer surface, causing a most disagreeble smell. An invention for the prevention of this, by coating the india-rubber tubing with a varnish, has been made in England. The chief novelty in it is that the varnish is easily made, and it renders the substance of the tube impervious to gases. The varnish is composed of linseed oil, fine litharge, or white lead, in the proportion of one quart of oil to one pound of litharge. These substances should be well boiled together until brought to a proper thickness or body, and while hot the composition is applied by running it through the tube to be coated or lined. The varnish for the outside is made by mixing one quart of linseed oil with half a pound of litharage, and by adding to the same about a gill of gold size, these ingredients should be well boiled together, and while hot should be applied with a brush or a sponge.

If a shaft springs in running one of three things is certain to occasion the difficulty; either a too small diameter of the shaft for its weight and velocity, a set of unbalanced pulleys, or an unequal strain on either side by the belts. Either of these may be remedied.

Mr. Graham's Experiments with Hydrogen.

At the February meeting of the Royal Institution in London, Dr. Odling delivered a lecture upon the new discoveries made by Mr. Graham, F. R. S., respecting the properties of hydrogen, tending to prove that hydrogen is a metal having a boiling point much below the temperature of the air. The lecturer took a tube closed at one end with a single thickness of well-moistened calico, and showed that when the tube was half filled with water, and its lower end just dipped below the surface of some water in a glass vessel, the water in the tube would not run out, because the wet calico was, practically speaking, air-tight. Air could only enter the tube by dissolving in the water upon the calico, and then evaporating on the other side—a very slow operation. Ammonia being a gas much more soluble in water than common air,a jar of it was inverted over the wet calico; it was quickly dissolved in the water, and evaporated on the other side, so as to push down the column of water in the tube. In the same way gases are believed to pass through india-rubber and colloid septa by first dissolving in the material of the diaphragm, then passing through it as a condensed volatile liquid, and finally evaporating on the other side.

M. Deville, a French chemist, proved that hydrogen gas would pass through red hot solid platinum. Mr. Graham took up the discovery of M. Deville, and, by other experiments made, gained fresh information respecting these phenomena. He showed that platinum absorbed a certain quantity of hydrogen before the transmission began, as is the case with india-rubber. Next he tried palladium, and discovered that this metal will absorb or occlude about 1,000 times its own volume of hydrogen gas, the greatest amount taken up in the actual experiments being 980 times the bulk of the palladium. One volume of water will dissolve 800 times its volume of ammonia, the water being then increased in bulk by one half—that is to say,that two centimeters of water, after absorbing 800 times their volume of ammonia, will have increased to three cubic centimeters. Palladium does not increase in bulk to anything like the foregoing extent when it absorbs hydrogen; it only enlarges to 1-20 or 1-21 of its former volume, after taking up 900 times its bulk of the gas,in which operation the hydrogen is reduced to 1-19,000 of its former volume.

The enormous mechanical pressure necessary to compress hydrogen to this extent, would equal that at the base of a column of mercury three times as high as Mont Blanc, supposing hydrogen, at such a pressure, still to obey the laws of gases, and to possess all the properties of a gas. The weight of hydrogen, thus absorbed, is from 8-10 to 9-10 that of the palladium. Mercury can be boiled into an invisible gas, and analogy seems to point out that hydrogen, at all temperatures yet produced by man, is similarly the vapor or gas of a metal, and that, by a sufficiency of pressure or cold, it may be reduced to a liquid metallic state, so as to resemble quicksilver. Many chemists support this opinion,much evidence on the point having been brought to bear by M.Dumas.

In physical properties the gas acts like a metal, by conducting heat with facility. Dr. Odling illustrated this by passing a current of electricity through two platinum spirals, till the two coils of wire kept at a white heat. Over the one spiral he inverted a jar of common air, and over the other a jar of hydrogen, and the latter cooled the wire so rapidly that it ceased to glow. He said that it was but fair to state that Dr. Tyndall's questions whether the cooling effect shown in this experiment is due to the rapid conduction of heat by the hydrogen; still, it is the prevalent opinion, that conduction by heat really causes the cooling, and Professor Magnus, of Berlin, has come to the same conclusion. Mr. Graham's experiments also favor the view that hydrogen is a metal.

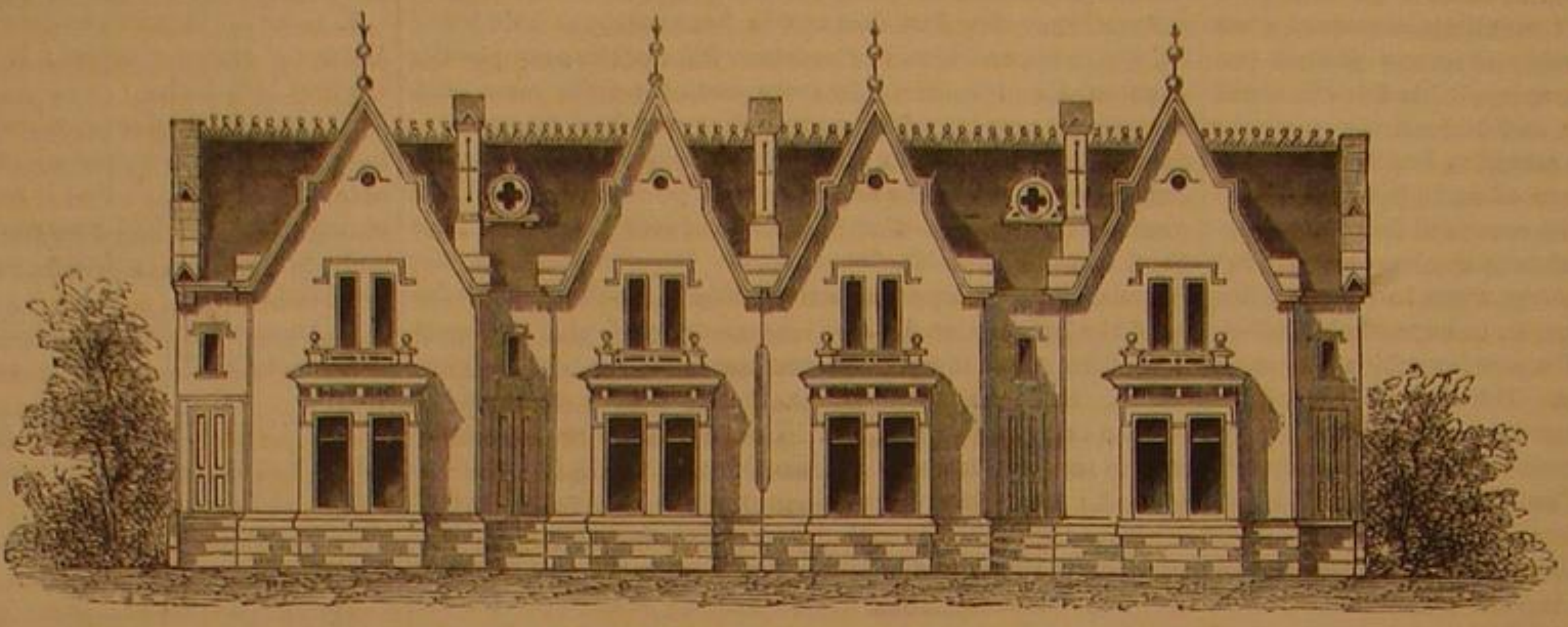
Dr. Odling then proved that the condensed hydrogen has a more powerful action upon reducing agents, than when in its ordinary state, by showing its bleaching action upon several colored solutions of chemical reagents. The greatest absorption of hydrogen by palladium, takes place at moderately low temperatures, but a high temperature is necessary for the passage of the gas through the solid metal. He then took a tube of palladium, closed at one end, and connected the other end with the Sprengel air-pump. A tube of glass was then slipped over the palladium tube, and a stream of hydrogen gas passed between the two, which were then made hot in the middle by the flame of a Bunsen's burner. The hydrogen gas then passed readily through the solid metal, being, it is supposed, liquefied in the pores of the palladium, and as it evaporated again inside the tube, the Sprengel pump delivered it into a glass vessel inverted over a trough of mercury. The hydrogen thus collected was then set on fire by the lecturer, to prove that it was hydrogen and nothing else.

Dr. Odling showed that a palladium wire is elongated after being allowed to absorb hydrogen for half an hour; but the remarkable fact is that when the gas is driven out again by heat the wire contracts, not to its original length, but to less than its original length. The cause is not known. As a final illustration of the probable metallic nature of hydrogen, a bar of palladium, charged with the gas, was suspended by a fiber of silk in the field of an electro-magnet, and was seen to be attracted like iron, though not so strongly. The bar had thus acquired a metallic property, not possessed by palladium in its unalloyed state.

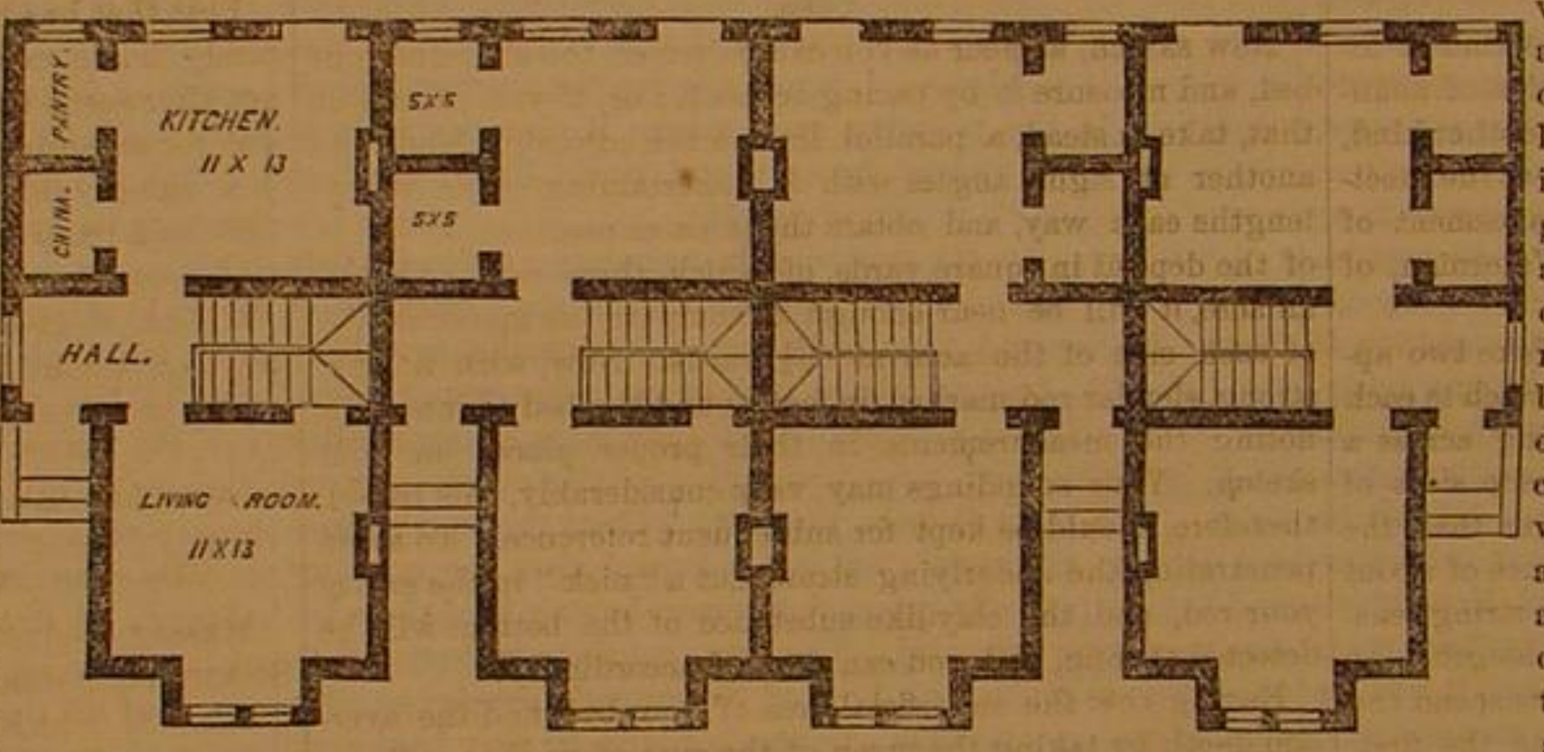
Strength is a general term. The strength of an iron bar resisting torsion is entirely different from the strength of the same bar resisting deflection or tension. No general rules can be applicable in all cases.

Plan for a Block of Cheap Houses on 75-Foot Lots.

We copy from the *American Builder*, of Chicago, a plan for a block of buildings, for laborers and others of small means, which is not only pretty, but cheap; a block of four such buildings, it is estimated, can be erected in that section for $4,000. The elevation at once strikes the eye as being exceedingly cosy and tasty, while the plan of the first floor, which we also give, shows that such a house may indeed possess conveniences which many more pretentious structures are destitute of. The cottages are two stories high, with attics; and the upper floors, being arranged to meet individual requirements, may be made to accommodate quite a large family.



BLOCK OF CHEAP HOUSES ON 75-FT. LOTS.



Brass Chains for Gaseliers.

A correspondent of the *London Times*, states that it is only a question of time as to the certain fall of gaseliers, the consequent escape of gas, and a very probable explosion, so long as the weights which hold up gaseliers are supported by brass chains. He attributes the deterioration of brass chain to decay by the action of the atmosphere and says the only wise remedy is to discard the use of brass chain altogether and to substitute copper chain in the place of it. In this explanation of the weakening of the chain he is undoubtedly at fault. The true reason is given by another correspondent to the same journal who writes as follows:

"In a letter in the *Times* of to-day attention is properly directed to the danger which may occasionally arise from the use of brass chains for suspending gaseliers. This is a subject on which during many years I have been collecting information. I have seen brass wire, about an eighth of an inch thick, after having been subjected to occasional vibration while stretched, become so tender and brittle in the course of a few weeks as to be capable of being easily broken into short pieces between the fingers. I have also seen the links of brass chains, which have been employed in suspending gaseliers, undergo a similar change, though in a less degree. These effects, so far as I have observed, have been due to spontaneous physical changes in the metal, and not, as your correspondent states, to atmospheric corrosion. It is well known that other alloys undergo singular spontaneous changes. Brass which has become tender and brittle may, by annealing, be rendered as tough and flexible as at first. It appears that only certain varieties of brass are liable to be thus affected; and, if so, the explanation will probably be found in the presence of foreign matters in small proportion. I have never seen copper become tender and brittle like brass."

Toys at the French Exhibition.

Not the least interesting of the English reports on the French Exhibition is that of Mr. G. C. T. Barclay on toys. According to this report the chief French toy is a doll, not a representation of an infant for a child to fondle, but a model of a lady attired in the height of fashion, a leading manufacturer changing the costume every month to ensure accuracy. As an excuse for this apparently early inoculation of childhood with a love for finery, it is explained that these dolls serve as models to colonial and other extra-Parisian milliners before they are handed over to their children. French dolls, unlike our wax-faced natives, have china heads. Mechanical toys, made in tin out of such refuse material as empty biscuit and sardine boxes by M. Dessein, are, however, in more commendable taste. This ingenious toymaker manufactures a train, consisting of a locomitive, tender, and carriage, in separate compartments, with a finish that admits of their running smoothly, packed in a cardboard box, for twopence halfpenny. His economical genius is rewarded with an annual sale of a million railway-carriages. Another train, having clockwork movement, which enables it to run round a table, he sells for less than three shillings. The mechanical singing-birds of M. Boutemps, shown in the Exhibition, attracted much admiration, but were too costly to become general favorites. Military toys, too, in France, commanded a large sale. M.Andreux manufactures 70,000 toy guns per annum, beside immense quantities of cannon, gun-carriages,swords,and othermilitary equipments. The taste for military toys is, however, on the decline, owing, Mr. Barclay says, to the present notion of giving children objects suggestive of the arts of peace. Nevertheless, M. Andreux sold 38,000 toy imitations of the Prussian needle-gun in three months, when that weapon was under public consideration. Prussian toys, as represented in the Exhibition, were not needle-guns, but the furniture of dolls' houses, horses and carts, sensible dolls open to caresses without certainty of destruction, and glass marbles. Mr. Barclay gives the palm to Biberach for tin toys. Messers. Rock & Craner seem to manufacture every description of carriage, cart, cab, omnibus, and perambulator of every nationality; our own insular peculiarities being catered for in the shape of Hansom cabs, with little wheels on the feet of the horses as well as on the vehicles. Bavaria has an original idea or two about toys. One of these is the popular model of a shop, manufactured at Nuremburg. The kind of shop that commands the largest sale is a grocer's—a selection accounted for on the ground of its having the most drawers to open and shut, full and empty. Another toy, not domiciled with us yet, consists of pictures of men, animals, carts, trees, painted on stiff cardboard, and furnished with a block of wood, to enable them to stand upright, which children can arrange in different combinations, and which appear likely to exercise their taste aud ingenuity. The Austrian conception of a toy appears to be, that it should be a musical-box internally, whatever form it may externally take; the Danish, that it should be an implement; the Moorish, that it should be either a trumpet or a top; and the Russian, that it should be made of india-rubber.

The Tennessee Chair Factory.

The *Daily Press and Times*, of Nashville, Tenn., contains an account of a visit to the above factory, located near that place, which it seems rivals in extent many of our Eastern establishments. It has an engine of sixty-horse power, and at present employs seventy hands. It has, however, capacity for about three hundred. The establishment is now turning out two hundred chairs daily, but with its full complement of men will be able to turn out eight hundred. We are glad to record these evidences of returning prosperity to the South, and we feel the assurance that a few years will more than restore her former commercial and industrial health, and establish it on a firmer basis than ever before.

Mines of the West.

J. B. Ford & Co. have issued a special edition of the Report of Rossiter W. Raymond, United States Commissioner of Mining Statistics, for the past year. It is entitled, "The Mines of the West:" a report to the Secretary of the Treasury; being a full statistical account of the mineral development of the Pacific States for the year 1868, with sixteen illustrations, and a treatise on the relation of governments to mining, with delineations of the legal and practical mining systems of all countries, from early ages to the present time. The information contained in this report is of value to those who take interest in the development of the mineral wealth of the West.

The East River Bridge.—Brevet Major-Generals Newton, Wright, and King met yesterday at Army Headquarters, in Greene street, as a Commission from Government to consider the feasibility of the East River bridge. They will meet daily for perhaps a month. There are many important points to be considered, such as the possible obstruction of navigation, feasibility of the project, etc., upon which, we trust, the committee will be fully satisfied, so that this great work may proceed without delay.

Beet Root Sugar.—We continue this week our series of articles on the beet root sugar manufacture. They are written by a practical engineer, formerly the superintendent of a beet root sugar manufactory in Belgium and perfectly familiar with all the details of the subject. The next number will be illustrated by suitable engravings.

Correspondence.

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

The Interference of Vibrating Pendulums.

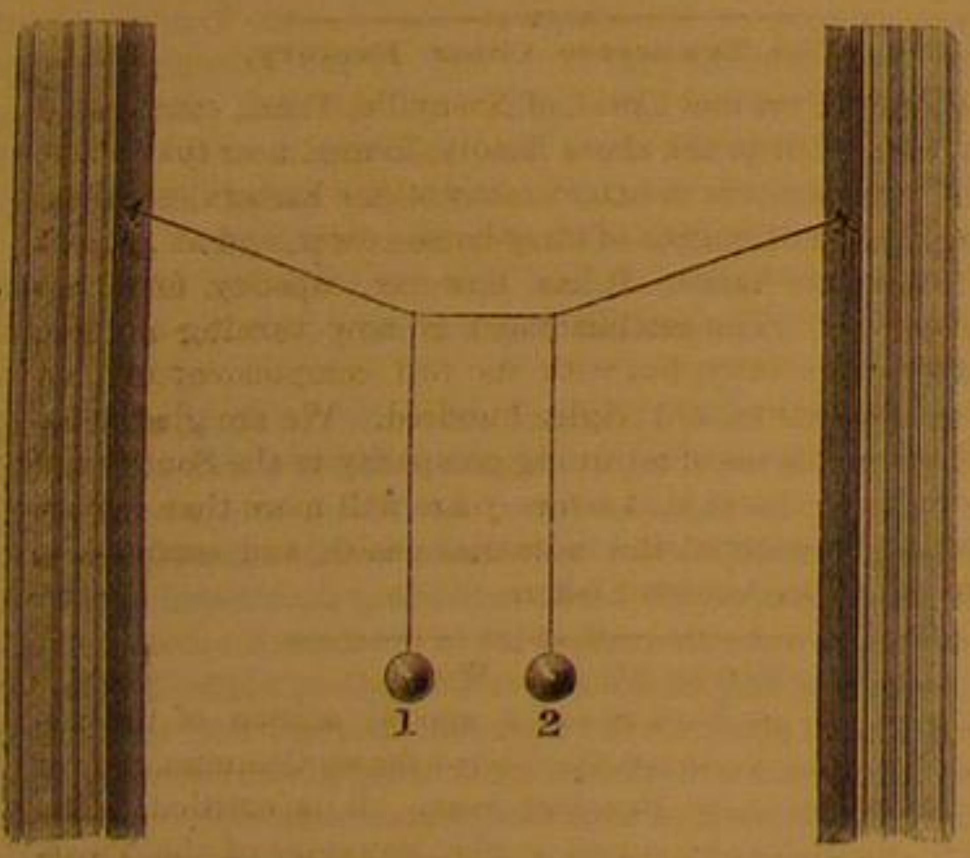
[Messrs. Editors :—In compliance with your request I send a sketch of the experiment with the interfering balls. I am very truly yours. E. N. Horsford.]

We often hear the word "interference" used to explain certain phenomena of light, heat, and sound. To the popular mind it is not easy to present an intelligible illustration of the process to which reference is made in the use of this word. We can understand that if a violin string be twanged at one end of a lead tube of, say, a thousand feet in length, the note peculiar to the tension or taughtness of the string will be heard by the ear applied at the other end of the tube. So would it be heard at the end of another tube a few yards longer than the first. Now it will not be so readily understood, why, if the two tubes be placed side by side to receive the vibrations of the violin string, and the longer tube be made to curve and enter the shorter, at a very sharp angle, just before its distant terminus, that the ear now placed at the end of the shorter tube will hear nothing. Let us see if we cannot present a mechanical conception of what takes place.

This is a case of interference. The sound is due to what may be called currents of alternate compression and dilation in the air, falling on the drum of the ear, throwing the membrane into vibration, the compressed air forcing the membrane inward and the dilated air permitting it to return. These alternate layers of compressed and dilated air are caused by the sudden backward and forward movement of the violin string. They produce the same effect on the ear when propagated through either tube. But when the two tubes—one so much longer than the other that the air at the distant terminus of the long tube is dilated, while that at the exit of the shorter is compressed—are joined, the stratum of compression in one will mingle with that of dilation in the other, and the air at the end of the shorter tube will have its normal condition of uniform density, and no oscillation of the drum of the ear be produced, and of course, no sound heard.

This illustration will at least give an idea of one kind of interference, and will open the way to the presentation of an interesting experiment illustrating interference of another kind, which was brought to the attention of the public at the meeting of the American Association for the Advancement of Science, at Burlington in 1867, by Mr. Henry Waterman, of Hudson, New York.

The experiment may be made by any one. Take two apples, or balls, or spools of about the same size. Attach to each a slender cord or strong thread. Suspend a string across a doorway, from tacks at equal hight on the opposite sides of the doorway. Let the string be a quarter longer than the width of the door so as to hang slack. At a distance of about three inches from the middle point of the slack string, suspend one ball, giving its string about two feet of length. At the same distance on the other side of the center, suspend the other ball, giving its string the same length as the first. The apparatus is now complete and this diagram will illustrate it.



Now taking hold of the ball 2, draw it from the doorway about a foot and let it swing. It will cause the other ball to commence swinging. After a few oscillations ball 2 will gradually come to rest, when ball 1 will have attained a maximum sweep nearly or quite equal to the original sweep of ball 2. Ball 2 will however immediately resume its oscillations and the other will gradually come to rest; in its turn, however, starting, rising to a maximum of sweep and subsiding to momentary repose. Thus the two balls will continue to interfere with each other for a long time.

If the string attached to one ball be shortened the phenomena will be modified: neither ball will come to absolute rest, but both will have alternately maxima and minima of sweep.

If both balls be drawn from the perpendicular on the same side, but one farther than the other, and both be released at the same instant, the effect will be the same as if one string had been shortened.

If, instead of starting the vibration through the doorway, it be instituted across it, that is, in the direction from one jam to the other, the same phenomena of alternate momentary rest and renewed oscillation will be observed.

If the vibration be commenced obliquely across the doorway the resulting phenomena will be wonderfully interesting, but difficult to detail, involving two sets of maxima and minima of effect, and a very complex system of alternate motions and rest.

Additional balls will modify the results, and the length and approximate taughtness of the string, as well as the distance of the support of the balls from the points of suspension of the slack string, will, in a great variety of ways, influence the phenomena. As a source of entertainment and a theme for investigation it will not be likely soon to exhaust itself.

Two or three points borne in mind will perhaps be of service in pursuing the subject as a problem of mechanics.

1st, When the two balls swing strictly together through the doorway the whole will be a pendulum, the length of which is the perpendicular distance of the balls, from a straight line joining the ends of the slack string.

2d, When one ball is at rest and the other swinging, the length of the pendulum is less, than when both are swinging evenly together.

3d, The time required for the sweep of a pendulum is greater as its length is greater.

Let me now give an application of the truth of this kind of interference.

Most persons are familiar with the fact that clocks are sometimes brought to rest, or their rate modified by the jarring of neighboring machinery. It is related that two clocks have been so placed on a common shelf that they have not only modified each other's rate, but have alternately brought each other to rest, and caused after each pause, the motion to be resumed. The action of two pendulums on each other, where the motion of the point of support of one may influence the motion of the point of support of the other, is shown in the experiment above detailed.

Persons fond of material conceptions of psychological phenomena, will find much of suggestive interest in experiments that show how vibrations may awaken or strengthen, or weaken or arrest their fellows; and I am persuaded that the simple apparatus I have described will afford lasting entertainment and food for thought to all, old as well as young, who will be at the trouble to put it in operation.

Peat.

[Concluded from page 230.]

ON HARVESTING AND MANIPULATING PEAT FOR HEATING USES.

Now sketch, as near as you can on paper, the shape of your bed, and measure it by pacing across it; or, if you cannot do that, take, instead, a parallel line on the adjoining land, and another at right angles with it, ascertaining approximate lengths each way, and obtain the area as near as convenient of the deposit in square yards, of which, there being 4,840 to an acre, it will be near enough to compute the measurement of each side of the acre at 69½ yards. Now, with a long, strong, slender rod marked, in feet, sound the bed at intervals, noting the measurements in their proper places on your sketch. Your soundings may vary considerably, this record, therefore, should be kept for subsequent reference. To avoid penetrating the underlying strata, cut a "nick" in the end of your rod, and the clay-like substance of the bottom will be detected therein, and you can proceed accordingly.

Having now the superficial area of your bed, find the average depth by taking the mean of the sum of your soundings, this multiplied into the area will give the cubical contents in peat. It is difficult to calculate accurately the quantity of useful material in a bed of peat. I find the published estimates differ considerably, and my own investigations greatly vary. These differences arise from the different proportions of water and foreign matter mixed with the peats, and also from their own different densities.

For most practical purposes, in estimating quantity by the cubic yard, peat, as ordinarily in the bed, will weigh from 2,100 to 2,400 pounds, and if drained in the bed, 1,340 to 1,490 pounds, and air-dried 320 to 380 pounds, when it will be found to be reduced to about one-fourth to one-sixth the original bulk.

Peat, saturated with salt water, is generally unfit for heating purposes.

The fine clay-like substance found underlying peat beds is sometimes marly, particularly where the saturating water holds lime in solution, as at the vast beds under the Cayuga marshes in the State of New York. But generally it is of a very different nature, an impalpably fine powder, varying in color from white to dingy slate, and from yellowish white to brown, and composed of infusorial shields of animalculæ—little shells which, under a microscope, are resolved into the most exquisite shapes and forms, yet not composed of carbonate of lime but of pure silex. It forms a superior powder for polishing metals.

In working a bed of peat, the first step will be to ascertain if drainage is necessary; and, secondly, how it can be effected and at the least cost. Generally the material removed in this process will be available for future treatment. If the bed cannot be economically drained, resort must be had to mechanical excavation, which I should only use from compulsion, as I doubt, all points considered, any practical advantages of mechanical over hand labor for that purpose. If, however, it is necessary, a most excellent and economical apparatus has been made and successfully used therefor. One man raising fifty lbs. of peat a minute, will lift and place fifteen tuns in ten hours, whereas some men will do more. It is best not to drain a bed below the level to which you can effectually work out in a season, unless you can close the outlet drain to allow it to fill again with water for the winter, for the reason that drained peat that has been frozen is apt to disintegrate after thawing, and become impoverished for a solid homogeneous fuel.

For economic heating purposes and rendering the peat compact, the substance must be kneaded to break up the sponginess reducing the mass to a smooth, paste-like, homogeneous consistency, which will dry hard and solid, without pressure. To effect this result, cheaply and rapidly, has been the great problem, a solving of which has occasioned many costly failures and annoying disappointment.

Many expensive essays have been made also to dry peat artificially, but always resulting, as trial for this end always must do, in final abandonment.

Many contrivances have also been invented for pressing the water from peat, and also to mold it under pressure, but never in either case with economic success; and I believe all systems for these purposes must eventuate in failure to produce a good fuel at remunerative cost; indeed, I know almost every conceivable plan has been exhausted for these objects and all failed alike; beside, all peat, from which water has been expelled by pressure, requires subsequent drying.

All that is needful to be done with excavated peat is to manipulate the mass properly, and expose it directly to the air until it is dried or fit for removal; and as its cost for fuel is almost entirely due to manual labor, the complete process should be accomplished by the least possible number of handlings, in the shortest possible time, occupying the least possible area of ground therefor, and in a given time producing the largest possible quantity in tuns of prepared fuel.

Various machines have been made embracing several distinct mechanical systems, and modifications of each. The most satisfactory being on the general principle of the "pug mill," for working brick clay, where a vertical shaft with working arms and kneaders is used. And those various patented contrivances have failed from their liability to derangement, or from breakage of some of the parts, or from insufficiency of product in a given time, or from inferiority of fuel made, or what is perhaps the shortest road to the trouble, the ultimate expense in producing 100 tuns of satisfactory fuel.

Aside from the necessity to turn off day by day a required amount of good work, the machine must possess within itself protection from injury against stones, bones, and even roots, which must pass unseen into the machine with the peat, and be separated and forced away from the working parts, while the general flow of the useful matter continues on unobstructed in its proper course, and such a machine has been made, tried, and proven to embrace all those essential elements of success.

Peat that has been well manipulated and dried for fuel rarely holds more than ten per cent of moisture, and it will not afterwards become saturated with water, even by immersion for an entire winter.

A cubic yard of closely packed peat fuel will weigh from 1,620 to 2,180 pounds, and the heating value of one pound of such peat is equal to even one and a-half pounds of wood. One cord of good wood will weigh almost ,4200 pounds, and one cord of peat fuel will weigh about 3,750 pounds, showing a gain in space as well as greater heating power.

J. B. Hyde.

New York city.

Do We Measure Horse-power Correctly?

Messrs. Editors:—On page 197, current volume of the Scientific American, I noticed an article signed "Mathematician," in which the author says: "When we wish to find the actual horse-power of a steam engine, and compute the same by multiplying area of cylinder by stroke of piston, pounds of steam, and number of strokes per minute, without other qualification, the result is erroneous. As for instance, apply the foregoing rule to a steam engine furnishing power for a machine shop, and running at the rate of seventy-five revolutions per minute, and let the result in horse-power be thirty; then disconnect, throw the belting off the power wheel, use the some amount and pressure of steam, and the number of revolutions will be doubled on account of outside resistance being removed. Now measure the horse-power by same rule, and the result will be sixty-horse power, which is evidently absurd; for it is equal to saying that the engine uses most horse-power when doing least work, and least horse-power when doing most work."

The above method of computing power, or "horse-power," as the author styles it, is not correct or not correctly stated. He says, "multiplying *area of cylinder* by stroke of piston, *pounds of steam*, and number of strokes per minute, without other qualification, the result is erroneous."

I believe it would necessarily be so, since the above data, are not required for computing power. All that is necessary is the mean total pressure of steam on piston and its velocity.

Example.—Suppose the total mean pressure of steam on the piston to be 1,000 lbs., and the velocity of the same 300 feet per minute, then by the above rule we have 300 feet × 1000 lbs. = 300,000 foot-pounds, indicated power of engine. For useful effect, exclusive of friction, see table of friction and make the necessary deductions, or apply a dynamometer.

To prove the accuracy of the preceding rule, let us take the experiment the gentleman proposes on an engine of thirty-horse power, driving a machine shop, and throw off the main belt. Of course he would have to disconnect the regulator, for if not it would close the valve. He says, use the same amount and pressure of steam, and the number of revolutions will be doubled. To use the same amount and pressure of steam would be impossible, for since the velocity is double, the cylinder will be filled twice as often and consequently if you use the same pressure the quantity would be double.

This would be an interesting experiment which I would like to see tried, provided I were out of the reach of the flying fragments. Suppose the engine consumed two-horse power when working seventy-five revolutions per minute to overcome the friction, and suppose the ports of the cylinder were of sufficient dimensions to allow a free passage to the steam; then thirty-horse power would drive the engine fifteen times as fast. For we have two-horse power × 15 = 30-horse power consumed in friction giving a velocity of 15 × 75 = 1125 revolutions per minute.

Consequently the engine would do what the gentleman considers absurd, viz.—Use most horse-power when doing least work, and least horse-power when doing most work.

The method he gives us for computing the power of an engine exclusive of friction is equally erroneous, as he supposes the friction to be the same, whether the engine is doing work or not, which is evidently wrong.

Again he says, "It must be admitted that a better test of the superior economy of one man's make of engine over another could scarcely be had than that of the amount of steam consumed in running any engine alone." I believe that the gentleman is also mistaken on this point. The fact is that a toy engine, like the one of which you give an illustration on the same page on which the gentleman's article appeared, would run with less steam alone than the most perfect engine yet made, on account of the simplicity of parts. I think it capable of demonstration that the poorest engine would run alone with the least steam, and also that a very bad engine may show a good card by indicator. B.

Newark, N. J.

Large Centrifugal Pumps.

Messrs. Editors:—In a recent number of your paper you published an extract, from the *Colliery Guardian*, about two large centrifugal pumps which had lately been made in England, and which were said to be the largest in the world. The writer of the article in question cannot have been very well "posted" as to the dimensions of some of the large pumps at present in operation—as I know of two (and there are probably others), each of which exceeds in size those described in the article referred to. These pumps are at present at work on the sugar estate of Messrs. Ewing, of Glasgow, in Demarara, and were made from the designs of Prof. James Thomson, C. E., Belfast, Ireland. The larger of the two was constructed under my supervision by Messrs. Harland & Wolff, Belfast, and as some of your readers may desire to know some of the particulars I give you the principal dimensions. Diameter over all, 15 feet 6 inches; diameter of wheel, 7 feet 9 inches; breadth of wheel at periphery, 2 feet 7½ inches; diameter of shaft, 7¼ inches; diameter of suction pipes (2), 4 feet 9 inches.

St. Louis, Mo. Jas. Simpson.

THE LAW OF STEAM.

By Prof. Julien M. Deby.

Regnault, the celebrated chemist and natural philosopher, in the published results of his admirable researches on steam, undertaken at the requisition of the French Government, while speaking of the intimate relation existing between the pressure and the temperature of steam, says: "The question we are at present studying is probably one of the least complex of the theory of heat, and if the law which governs it has not been made manifest by our experiments, this depends probably on the empirical definition given of *temperature*, which definition, in all likelihood, does not establish any simple relation between various temperatures and absolute quantities of heat."

He further says: "We are at present totally unacquainted with the theoretical law which connects the elastic forces of vapors with their temperatures."

Dalton, long before Regnault, propounded a law, stating that, while the pressures increased in geometrical ratio, the temperatures did so in an arithmetical one; and Faraday, to a certain extent, corroborated Dalton's theory during his investigations on the expansion of gases. More recent observations have, however, proved the fallacy of this supposed law, especially when applied to long ranges of pressures or to great differences in temperature.

Neither the researches of Arago and Dulong, nor those of the Franklin Institute, nor of other modern physicists have, to our knowledge, been able to solve the mystery, and we have, to this day, been reduced either to direct experiment or to the use of empirical formulæ in order to determine the temperature of any given pressure of steam, or, *vice versa*, to determine the pressure from the temperature.

The formulæ for this purpose are quite numerous; but as I have said before, they are, without exception, purely empirical; and their results must be considered only as rough approximations to practical results. Many of these formulæ are complex, involving quantities to be raised to the fifth or sixth power or require the extraction of the fifth or sixth root, and combine the use of various constants and coefficients with multitudinous rows of decimals attached to them.

How much more simple the matter really is, I shall now proceed to show, leaving those who take interest in the subject to judge for themselves, whether or not Dame Nature has long mystified the mathematicians in this special case.

While reflecting on the theory which regards heat as a mode of motion, it occurred to me to think of the cause of the well-ascertained fact, that the latent heat of steam decreases as the tension increases, and this naturally led me to the conclusion, that, in all probability, as the pressure of steam increases so is a portion of the latent heat really converted into this pressure itself, or, more properly speaking, the tension is in reality itself only modified latent heat.

Expressed mathematically, if such be the case, no matter what the tension is, we have: Tension of steam (a certain amount of motion) + latent heat of same steam (a certain amount of motion) = total amount of heat (total motion) in steam.

In order to ascertain if I was right in my supposition, I took up—not any of the tables calculated by the formulæ of various authors, but the results of direct experiments made by the most reliable scientific authorities—and I soon had the satisfaction of discovering that I had, to all appearance, solved the gordian knot.

The tension of steam, or its elastic force, does not present any natural simple relation to either thermometric temperature or to the total units of heat supposed to be contained in steam, but is most intimately related to its latent heat, a portion of which, in fact, it really is. According to my views, the simple law reads as follows:

While the pressure of steam increases in a geometrical progression, the latent heat decreases in an arithmetical progression, and vice versa.

If the pressure in atmospheres be as 1, 2, 4, 8, 16, 32, etc., the corresponding diminution in latent heat will be, respectively, as 1, 2, 3, 4, 5, 6, etc. The same would occur with the series 3, 6, 12, 24, 48, 96, etc., or 5, 10, 20, 40, 80, etc., or any other.

If we take 537 C. units of caloric as the quantity of "latent heat" in steam, indicating 100° C. on the thermometer under atmospheric pressure, we find that the difference between the terms of the above arithmetical progression is 17, or a number which approximates to it within a very minute fraction.

This number of 17 units of heat is an average of the differences found by me to exist between a large number of the carefully *observed* temperatures, noted by Arago, Dulong, and Regnault, as corresponding to *observed* pressures.

It gives us:

Pressure in atmosphere.	Latent caloric.
1	537 units.
2	537—17
4	537—17 × 2
8	537—17 × 3
16	537—17 × 4, etc.

By interpolation, I have formed the following table, showing the latent heat (which may always be readily calculated from the thermometric indications, by means of Regnault's formula T ·305 + 506·5 for Centigrade degrees, or (T—32)·305 + 911·7 for Fahrenheit degrees, and the corresponding pressures of steam in atmospheres, from 1 to 16. The temperature is also readily calculated from the latent heat by the formula T=606—L÷·695, in which L represents the units of latent heat.

The letter A indicates the units of latent heat of steam of 100° C., or 212 Fah. or of atmospheric pressure, and b indicates the number corresponding to the difference between two terms of the arithmetical progression. I shall here only exhibit the Centigrade series in numerals.

Pressures in atmospheres.	Corresponding units of latent caloric.	In general.
1	537	$A-o$
2	537—17	$A-b$
3	$537-(17+\frac{17}{2})$	$A-(b+\frac{b}{2})$
4	$537-(17\times2)$	$A-(b+b)$
5	$537-[(17\times2)+\frac{17}{4}]$	$A-(b+b+\frac{b}{4})$
6	$537-[(17\times2)+(2\times\frac{17}{4})]$	$A-(b+b+2\frac{b}{4})$
7	$537-[(17\times2)+(3\times\frac{17}{4})]$	$A-(b+b+3\frac{b}{4})$
8	$537-(17\times3)$	$A-(b+b+b)$
9	$537-[(17\times3)+\frac{17}{8}]$	$A-(3b+\frac{b}{8})$
10	$537-[(3\times17)+(2\times\frac{17}{8})]$	$A-(3b+2\frac{b}{8})$
11	$537-[(3\times17)+(3\times\frac{17}{8})]$	$A-(3b+3\frac{b}{8})$
12	$537-[(3\times17)+(4\times\frac{17}{8})]$	$A-(3b+4\frac{b}{8})$
13	$537-[(3\times17)+(5\times\frac{17}{8})]$	$A-(3b+5\frac{b}{8})$
14	$537-[(3\times17)+(6\times\frac{17}{8})]$	$A-(3b+6\frac{b}{8})$
15	$537-[(3\times17)+(7\times\frac{17}{8})]$	$A-(3b+7\frac{b}{8})$
16	$537-[(3\times17)+(8\times\frac{17}{8})]$	$A-4b.$

I am at present occupied in computing the latent heat of all pressures, from 1 to 16 atmospheres and up to 1,000ths parts, which will furnish more complete data than any extant.

In order to facilitate at once to others the verification of my statements, I will limit myself to showing how the 10ths, 100ths, and 1,000ths are interpolated by an example.

PRESSURE FROM ONE TO TWO ATMOSPHERES.

TENTHS.

		Units.
Atmospheres	1	537
"	1·1	$537-\frac{17}{10}$
"	1·2	$537-2\times\frac{17}{10}$
	. . . . . .	
"	1·9	$537-9\times\frac{17}{10}$
"	2	537—17

HUNDREDTHS.

		Units.
Atmospheres	1	537
"	1·10	$537-\frac{17}{10}$
"	1·11	$537-(\frac{17}{10}+\frac{17}{100})$
"	1·12	$537-(\frac{17}{10}+2\times\frac{17}{100})$
	. . . . . .	
"	1·99	$537-(9\times\frac{17}{10}+9\times\frac{17}{100})$

THOUSANDTHS.

		Units.
Atmospheres	1	537
"	1·101	$537-(\frac{17}{10}+\frac{17}{1000})$
"	1·102	$537-(\frac{17}{10}+2\times\frac{17}{1000})$
	. . . . . .	
"	1·999	$537-(9\times\frac{17}{10}+9\times\frac{17}{100}+9\times\frac{17}{1000})$

I have applied my formula to most of Regnault's practical observations, taken high and low in the scale, and find the discrepancies to be really insignificant.

He gives, for instance, pressure 1·905 atmospheres; observed temperature, 119·16; latent heat, 523; I find 521,615, or a difference of only 1·385 units. Another is T=119·16; pressure, 1·924 atmospheres; latent heat, 522·2; I find 521·292 units, or a difference of 1·008 units.

Among the higher pressures, we find: Pressure, 13·344 atmospheres; temperature, C., 193·8; latent heat, 472·2. We here, by our theory, have 473·662, a difference of 1·42 only; and again, P=13·625; T=194·8; latent heat, 471·2, when I find 474·047, a difference of 2·847 units.

The above are only a few examples, taken at random from among many, to serve as a verification of my law, but all those I have tried have approximated as closely to the practical results of experiment as those we have just quoted.

I have rapidly penned the present notice for the purpose of eliciting the opinion of others upon this important and interesting subject.

In a future article I may furnish various practical formulæ in connection with it, and will enter into the discussion of the relation existing between, so-called, latent heat and the volume of steam, as also its connection with the present theory of expansion and condensation, all of which we hope to show, have the most intimate dependence on its amount.

Let us conclude by reminding the reader, that we are, in all probability, fast approaching the day when it will be admitted by all sound philosophers, that only one law exists in nature, MOTION, the modes of which are familiarly known as heat, light, electricity, chemical affinity, molecular forces, gravitation, innervation, etc., all of which will be found to be perfectly convertible into one another. This will constitute a sufficient proof of their identity.

THE SEWING MACHINE—ITS ORIGIN AND SUGGESTIONS FOR IMPROVEMENT.

In the year 1825, there lived in the city of Saint Etienne, in France, a poor and obscure tailor whose patrons were few and far between. His carelessness about the work intrusted to him, joined to his eccentric habits, obtained for him throughout the neighborhood an unenviable reputation, the natural consequences of which were that his business declined from day to day and he ended by becoming a veritable pauper. In 1827, he was considered as laboring under the constant influence of hallucinations, and in 1829, he was unanimously regarded by the gossips of his precinct as insane.

This madman was no other than Barthlemy Thimonnier, the inventor of the first sewing machine. He was born at Abreste in the year 1793, and was the son of a dyer of Lyons.

It is an old custom with many manufacturers of the south of France, to give out large quantities of needle-work and embroidery to the country girls residing around their establishments. This attracted the notice of Thimonnier and originated in his mind the first idea of a sewing machine. On its construction he worked without help or money during four successive years, at the expiration of which, in 1830, he obtained his letters patent.

A government engineer by the name of Beaunier, living at Saint Etienne at the time, examined the machine, and appreciating at a glance the value of the invention, took the tailor with him to Paris, where a firm was soon started under the title of "Ferrand, Thimonnier, Germain, Petit & Co., with a view to the profitable working of the patent.

In 1841, in the Rue de Sevres, might have been seen a workshop, in which eighty wooden sewing machines were constantly employed in making army clothing.

That same year, however, the tide of a fierce revolutionary outbreak swept over France, and the laboring men of the capital, in their blind and ignorant fury, saw in this new substitution of machinery for manual labor, nothing but a means of robbing their wives and daughters of their daily bread. The consequence was exactly the same as in the case of the canal boatmen of Münden, who destroyed the first steamboat started there in the year 1707, and of the Belgian weavers, who some years ago broke up the first flax-spinning machinery imported from England into the city of Ghent. An armed and infuriated mob smashed all of Thimonnier's machines, and he himself had to flee for his life.

Soon after this Beaunier died, and the firm of Germain, Petit & Co., was dissolved leaving our poor tailor out in the cold.

In the year 1834, Thimonnier returned to Paris, and having improved his machine, attempted to make a living by taking in sewing. In this, however, he failed, and was at length obliged to walk all the way back to his native home with his machine upon his back, exhibiting it as a curiosity along the road in order to enable him to purchase his daily meals.

After this sad experience it would be thought Thimonnier would have given up the matter in despair, but, on the contrary, he went to work and constructed several new machines which he disposed of with the greatest difficulty.

In the year 1845, the date of Howe's patent in America, the French machine was already making two hundred stitches a minute.

M. Magnin, of Villefranca, at this crisis joined our inventor, and furnishing the necessary funds, the construction of ten-dollar machines was at once begun by them, with a fair prospect of pecuniary reward. In 1848, these machines made three hundred stitches per minute, and could sew and embroider any material from muslin to leather inclusive. The woodwork had now also been replaced by metal.

In the memorable month of February, 1848, another convulsion of the people took place in France, and for the second and last time were Thimonnier's hopes of success entirely blighted, himself and his partner being completely ruined by it.

He sold his English patent to a Manchester company for a trifle, sent his best machine in 1851 to the great London Exhibition, but too late to be noticed; and, finally, after thirty years of a life of incessant struggle and adversity, he died at the age of 64, in the greatest poverty, on the 5th day of August, 1857, at a place called Amplepuis.

While our poor tailor was starving in Europe, the sewing machine was being perfected on a new principle, in the United States, and in 1845, Elias Howe, Jr., obtained his patent out of which he eventually made quite a large sum of money.

Since 1852, American sewing machines by various makers have taken the premiums at all the shows, and were soon known and appreciated over the whole civilized world. At the present time improved machines, together with a few original patterns, are manufactured in England, France, Germany, and other countries, some of which are not surpassed by our own, being compact, cheap, and simple, and work rapidly and efficiently. If our manufacturers wish to contribute to the wants of the outer world in sewing machines, they must apply their energies and ingenuity to perfect their machines as some of them appear to be doing.

A good needlewoman with her needle makes from twenty-five to thirty stitches per minute, while a modern sewing machine will make one thousand; and yet we cannot call this last a *labor-saving* machine, so far as regards the operator on it. As compared with sewing by hand, the sewing with the machine is a really very laborious and fatiguing occupation.

A general law of mechanics is that whatever we gain in speed must be compensated by increase in power. For every extra stitch over the twenty-five or thirty mentioned above, a greater effort will be needed from the operator, until she may occasionally be taxed to her very utmost.

Increased power in this case is increased muscular action; muscular action needs fuel for combustion in the human machine; fuel for combustion means increased expense for daily food, a strain on the digestive organs, or a certain and dangerous physical waste of the individual. Our stage and street car horses are changed several times a day, but sewing girls at their machines are expected to work for ten or twelve consecutive hours with intermittent but continually repeated motions of the muscles of the lower limbs. Persons express surprise, if the remark be made that the poor operator is actually wearing herself out, and this much more rapidly than the slight movements she is making would seem to indicate.

We have before us a very interesting report, addressed to the "Société Médicale des Hopitaux," in 1866, by Doctor Guibout, on the sanitary condition of the many sewing machine operators which came under his personal notice in the public hospitals of Paris. Hollow cheeks, pale and discolored faces, arched backs, epigastric pains, predisposition to lung disease, and other special symptoms too numerous to be specified, were found to be the general characteristics of all the patients.

In the public houses of correction, where the female prisoners are obliged to work at sewing machines, in order to contribute toward diminishing the public cost of their detention, it has been found indispensable to issue to them supplementary rations over the usual diet of the establishments in order to keep them in good health.

These disastrous effects must eventually tend toward the deterioration of our race, and deserve, in a humanitarian point of view, the most serious consideration of all friends of mankind.

The way to remedy these evils is simple enough, viz., to make the sewing machine an automotor. In large establishments, where numbers of them are in daily use, steam has been applied with success, simple contrivances allowing them to be stopped or their speed to be increased at the will of the operator. Steam, however, is unavailable in private dwellings; and here we meet with a need which American inventors ought long ago to have fully and satisfactorily supplied, that of a "family" automatic machine.

The only really practical device of the kind with which we are acquainted (and this leaves much to be desired), is the electro-magnetic automotor invented in France by H. Cazal, which occupies so little space that it may be hidden under a foot stood. The fact that the cost of combustion of zinc is thirty times higher than if the power had been obtained by the combustion of coal, is to a certain extent compensated by the advantages of absence of boiler, fires, smoke, smell, or dust. Four of Bunsen's elements are sufficient for driving an ordinary sewing machine at a cost of fifteen or sixteen cents per day.

The apparatus itself consists in an iron pulley with an externally toothed rim, which revolves freely within a metallic ring, toothed similarly to the pulley, but on its internal surface, so that the points of the teeth of the pulley, face and approximate to those of the outer circle. An insulated wire runs over the pulley, which thus becomes a magnet whenever an electrical current is run through it, and ceases to be so from the very instant that the current is interrupted.

While the current from the battery is active, each of the teeth of the pulley attracts its opposite on the rim, and if the current were to remain constant, each of these would remain *in situ* and no motion would be imparted to the wheel; to avoid this, a commutator, which is set in motion by the motor itself, regulates the passage of the electrical current through the wire and renders it intermittent. As soon as the apexes of the teeth have placed themselves into opposition, the current ceases and the teeth on the pulley proceed onward, when a fresh current forces them into a second opposition with the next set on the rim, and so on indefinitely, producing a very satisfactory rotary motion. The power being symmetrically disposed around the axis and in each tooth, there is very little friction on the bearings and no noise produced. The speed can be varied at will, and the simple pressure on a knob or button causes instantaneous stoppage.

It is our conviction that electro-magnetic, or other small motors, fit for many domestic uses, could easily be devised, superior to even the simple machine of Cazal. We recommend this subject to the immediate attention of our mechanics and engineers. Should they succeed, they will have found not only a source of wealth for themselves, but they will have contributed their mite towards alleviating some of the thousand hidden miseries incident to our modern civilization, and will thus have acquired a right to the gratitude of their laboring brothers and sisters.

SHAFTING, PULLEYS, AND BELTS.

Improperly hung shafting, unbalanced pulleys, and crooked and badly constructed belts absorb an amount of the power used for manufacturing purposes that would probably, if known, astonish the most observant. When it is considered that this power is costly—costly not only in the first means for its utilization, as in the construction of a dam, flume, wheel, etc., when natural water power is employed, but eminently costly when the source of power itself is an item of continual expense, as in the employment of steam—it will be conceded that the subject of saving the amount now wasted from imperfection in the means of its transmission, cannot be of merely slight interest. Too many of our shops and manufactories present a spectacle, anything but pleasant to the mechanical eye, in sprung shafting, cut boxes, inefficient belts, unbalanced pulleys, shafts of insufficient size, and a general lack of evidences of intelligent arrangement and proper management. Some, it is pleasant to say, are models in all these respects; the manager allows no leaks to escape his observation; from the source of the power to its ultimate delivery, every step and every means are carefully scanned and kept in perfect order. For such, any directions we may give, any advice we may offer, any suggestions we may make, are superfluous. We write the following for others.

Before selecting the iron for a shaft, or for several lines with their counters, the machinist or millwright should take into consideration the weight each section of shaft is to sustain in the size of pulleys and strain of belts, the distance between points of support (boxes), the velocity of the shaft, and the nature of the machinery it is to drive. In all cases the iron for shafting should be chosen for its homogeneousness and perfection of rolling, seen by the finish of its surface. Each section should be handled carefully in transportation. As it comes from the mill it is usually straight, or nearly so, but teamsters and dealers in iron bars seem to suppose that no more care is necessary in handling a bar calculated for shafting purposes than in treating so much scrap iron. Frequently the lengths come crooked, bent, and sprung, to the hand of the machinist; they receive in transit no more consideration than the trunks of passengers on a railroad or steamboat at the hands of baggage smashers. It would be well for manufacturers of rolled iron for shafting, if they would follow the example of steel makers, or of Jones & Laughlins, manufacturers of cold rolled iron at Pittsburgh, Pa., and pack their bars in boxes. It would be well not only for them, but for the workman who is to convert these bars into shafts.

And here let us say a few words in favor of a most meritorious improvement, that just referred to, *en passant*, the cold rolled shafting. Its first cost is greater than that of the best refined iron ordinarily used for shafting, but it comes with a perfect finish, rolled to perfect size, without bend, kink, or spring, is ready at once to receive pulleys, and only requires centering and sufficient turning at the ends to give a shoulder for the couplings; although if the coupling adapted for it and illustrated in No. 20, Vol. XVII, SCIENTIFIC AMERICAN, be used, the end turning may be dispensed with if not the centering.

But, passing from this style of nearly perfect shafting, let us look at the processes to be employed to produce proper sections where they must be turned. The first process is the straightening. To begin at the beginning, the shaft should be centered at the ends. It is evident this center must be found by the circumference. If the shaft is bent or straight, in either case the center should found and drilled, before any attempt to straighten the shaft is made. For this purpose the ends of the shaft should be squared. This is done preferably by the vise and file; for if placed on temporary boxes in the lathe in order to use the side, or squaring-up tool, we do not know that the bearings of the shaft are true, and it cannot be placed upon centers until center holes are made, and this is our first object. Let the machinist take the shaft or bar to his vise, resting one end on the floor, and file by the trysquare until he has the end square with the longitudinal surface; the center punch and dividers will give him the proper center. This, be it borne in mind, before any attempt at straightening is made. We are aware that a centering lathe is frequently used, and if used judiciously it is a valuable machine, even for crooked or sprung bars, but for those who have not this tool the plan above is sufficient.

The center being found, drill by the hand or breast drill, if a lathe is not convenient, a hole of about one-eighth of an inch diameter at least half an inch deep; then chamfer or flare the hole with a cone-shaped drill, milled on its face—not a four-sided or three-sided tool, or a flat drill of two sides, but one circular to bear on every point at the same time.

The shaft is now centered, and is to be straightened. To determine how much out of true it is, suspend it between the centers of a lathe and rotate it by hand; no dog is required. If sprung in a long sweep, put a block of solid wood across the ways of the lathe, with a hook bolt projecting above it at the rear end, and use a wooden bar as lever, placing one end under the hook, and at the other end apply your weight. Any crook not too short can thus be straightened. If short crooks occur, not manageable in this way, do not strike the iron cold on an anvil, but heat it to a red, or nearly so, and then straighten, not by the direct blow of the sledge, which will indent the iron, but through the medium of a hollow "former," the reverse of the "fuller," so that the iron is not injured.

We place great stress on this method of straightening kinks, as we know that not only is cold hammering injurious in indenting the iron, and injuring its texture, but that after these indentations are removed by the turning tool, if it goes so deep, the crooks sometimes return, like curses, to vex the peace of mind of the ignorant or careless workman. Turning the shafting must be deferred to another time.

BEET ROOT SUGAR IN THE UNITED STATES.

The *Evening Post* (Chicago), in noticing our announcement that we would give a series of practical articles on the manufacture of beet root sugar and expression of our belief that Yankee beet root sugar will, at no distant day, be offered in the markets of the world in successful competition with both colonial and European brands, admits it to be "a very comforting and encouraging fact, if fact it shall prove to be." It, however, throws some doubt upon the probability of successful beet root sugar manufacture here, based upon the very partial success hitherto attained in the attempt at such manufacture up to the present date. It says: "The establishment at Chatsworth, in this State, which was hailed when first begun as a certain triumph of low priced land and a home market over the competition of cane-growing districts, has had anything but an encouraging experience. A very large sum of money, probably not less than $300,000, has been expended by the company, but, thus far, without anything like the expected return. It is said that all the causes of failure are easily explained—that a bad crop of beets in one year, insufficient and defective machinery in another year, a want of water in a third year, will account for the continued inability of the works to pay."

Those acquainted with the history of this establishment, and who have a knowledge respecting the details of the manufacture, will readily admit that the causes assigned are ample to account for the "inability of the works to pay." These works are, however, doing better than the *Post* seems to think. It is stated, that during the last year they made a million pounds of sugar, which ought not to imply anything like imminent bankruptcy.

The *Post* states strongly the difficulties which attend the introduction of new industries, and shakes its head doubtingly thereat. But there are plenty of precedents to reassure it and other doubters. Of these we will instance only one, the silk manufacture, now a profitable and permanently-established industry on this continent. Surely, on the score of failures in the few and imperfect trials hitherto made in the beet root sugar manufacture, we find little to give reason for doubt when we remember the numberless failures and discouragements that obstructed the earliest attempts at spinning and weaving silk. It is hardly fair, however, to consider the only attempts worthy of the name, yet made in this country, as failures until it shall be proved beyond a doubt, that they have not only been doing business at little profit for the limited time they have been in operation, but have lost, and must continue to lose, from the insurmountable obstacles they are forced to encounter.

This has not yet been demonstrated, and the very fact that, notwithstanding the misfortunes of the works alluded to, it has kept its head above water, is, we think, evidence that it will not soon be demonstrated.

In this connection, it may not be amiss to give some figures from the New York *Shipping and Commercial List*, showing the extent of the sugar trade in the United States for 1868. The quanties are given in tuns of 2,240 pounds:

	Tuns.
Received at New York	259,073
Received at Boston	62,237
Received at Philadelphia	66,120
Received at Baltimore	53,458
Received at New Orleans	10,706
Received at other ports	10,380
Total receipts	461,974
Stock, January 1, 1868	45,746
Exports and inland shipments	8,246
Stock, January 1, 1869	41,942
Consumption of foreign in 1868	446,533
Consumption of foreign in 1867	378,068
Crops of Louisiana, Texas, etc	33,000
Total consumption of cane sugar for 1868	479,533

"The crop of Louisiana, now about made, is estimated at 100,000 hogsheads. The season has been unusually favorable—so much so that at one time strong hopes were entertained that the yield would reach 125,000 hogsheads; but the weather has recently been unpropitious, and the estimates have been reduced to the first mentioned figures.

"The insurrection in Cuba will interfere materially with the supply from that quarter. The crop of maple sugar in the United States the last year will be about 23,000 tuns, though the data is imperfect upon which the estimate is made. The production of sugar throughout the world, including the beet sugar of Europe and the palm and date sugar of the Indies, for the year 1867, is estimated at 1,299,600 tuns, of which Cuba produces nearly one-third; of this Great Britain and her colonies consumed about 689,000 tuns, and the United States 467,300 tuns—the two nationalities consuming nearly one-half of the world's supply."

It will be seen that the foreign sugar consumed in 1868 in this country exceeds that of 1867 by 68,465 tuns, or more than the increase in home production, although the season has been unusually favorable. We do not believe the American people will content themselves with dependence upon foreign countries for this important staple, when there is no solid reason for so doing. With our fertile soil, and fertile brains, it will go hard if we do not make beet root sugar supply our own consumption, with some to spare for export. Let us not expect too much from the brief experiments yet made; we have planted only a few small seeds, it is not yet time for the reaping.

PAIGE'S PATENT IMPROVEMENT IN STEAM BOILER FURNACES.

Where bituminous coal is used as a fuel to generate power, for steam engines or other purposes, much of the carbon, of a volatile character, is carried off and left to settle down through the atmosphere, to the annoyance of everybody in its vicinity and to the direct loss of the consumer. For want of legal enactments, such as exist in England, some of our towns and cities are rendered unpleasant to their inhabitants and unattractive to strangers. The unconsumed carbon, which vitiates the atmosphere, where bituminous coal is the fuel, is neither healthy nor comfortable. The object of the device shown in the accompanying engraving is to provide for the complete and entire combustion of the gases and of the volatile, but solid particles of fuel, usually carried off by the draft to be deposited in a solid form.

Fig. 1

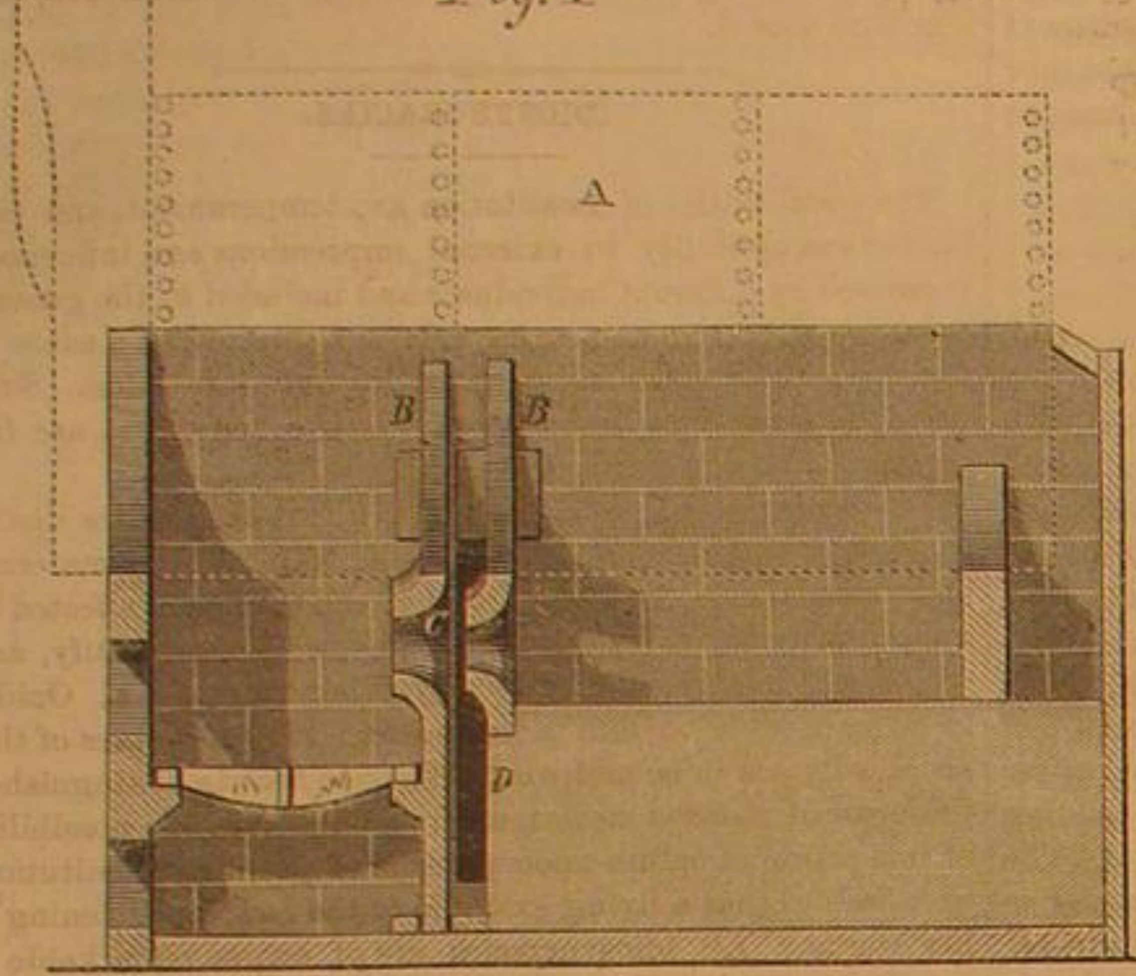
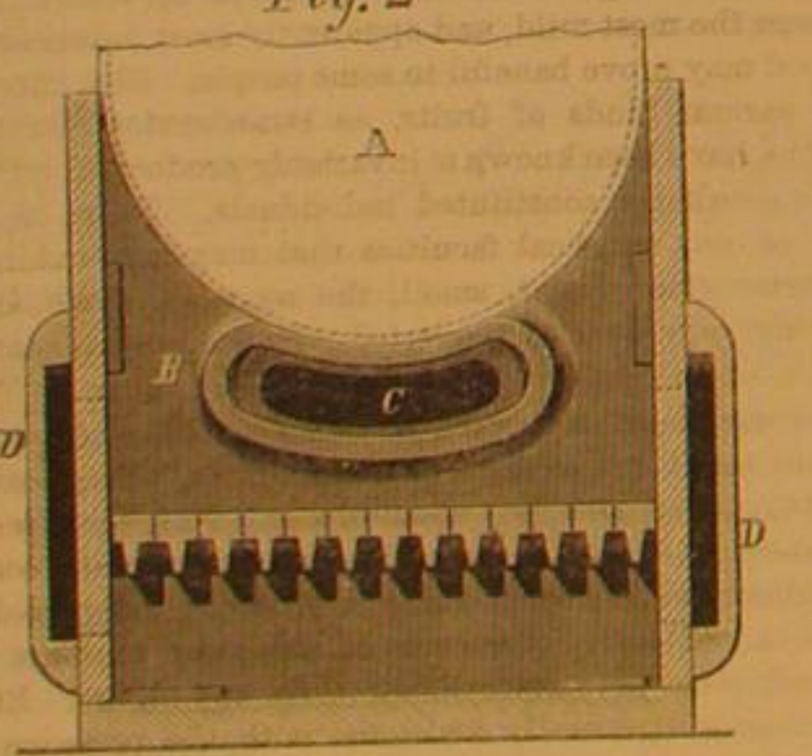


Fig. 1 is a vertical longitudinal representation of a furnace and boiler, and Fig. 2 is a cross section, taken on a transverse line at the rear of the grate. Similar letters refer to similar parts in both engravings. The furnace is of the ordinary style, its back, however, being an upright plate fitting the convexity of the boiler and the level of the grate, and having an opening of an elliptical form, but curved on its upper surface, to the circumferential line of the boiler. Another upright plate, similarly formed, is placed just behind the first, having a similar projection. These are seen in both figures: A is the boiler in Fig. 1 extending to the horizontal dotted line, and in Fig. 2 being shown in transverse section. B, in Fig. 1, shows the sections of the plates. The same in both figures show the form of the plates; and, in Fig. 2, at C, the whole contour of the openings is shown, also in section in Fig. 1, same letter—C.

The gases of combustion are met at a point between the two plates by a column of atmospheric air (oxygen) admitted through side apertures—seen plainly at D Fig. 2—to the space between the plates, B. It is evident that the outer air passing into the chamber, formed by the space between the

Fig. 2



two plates, and meeting the heated gases, smoke, etc., from the furnace, is at once expanded and intimately mixed with these products of combustion; not passing through the opening in the rear plate in a direct line, but deflected against the surface of the plate, and thus receiving a recoil or revolution before passing off with the draft. Thus perfect combustion is assured, and an intense heat results, that passes along the bottom of the boiler and envelops its sides. The inventor believes that not only is the smoke all consumed, but that the power of the heat and, consequently, the economic use of the fuel are increased twenty per cent. Where, as on vessels, the bulk and weight of the fuel carried are important elements in calculating the capacity of a ship, the advantage of such a device is apparent; and also where the cost of the fuel is an important item. This improvement may be applied to any ordinary furnace as well as to those built specially for its reception.

The inventor and patentee guarantees that the improvement will accomplish all that he claims, and invites those who desire further information to address J. L. Paige, No. 7 Howell street, Rochester, N. Y.

Treating Textile Fabrics.

M. Pierre Armand Neuman, of St. Denis, Paris, treats textile fabrics with sulphuric acid, for the purpose of rendering them impermeable. By this process the fibers on the surface of the fabric are partially dissolved, and converted into a glutinous substance, without the fibers in the body of the fabric being destroyed. The fabric, after being passed through the sulphuric acid, is quickly washed and rinsed in water, to stop the action of the acid, and remove all traces of it, and it is afterwards dried, when the part which has been acted on by the acid, having impregnated and coated the fibers of the fabric, and filled up the interstices between the warp and the weft, will convert it into a parchment-like and impermeable materiel.

Heat and Steam.

A correspondent writing to us on the subject of "Waste and Economy of Fuel," seems to misapprehend Joule and Tyndall. One cubic foot of water when transformed into steam, does not, as he supposes, only contain 1,169 units of heat, but contains 1,169 multiplied by 62½ pounds, or 73,062·5 units.

The steam engine furnishes a ready and convenient method of determining the mechanical equivalent of a unit of heat, and shows conclusively, we think, that Joule's figure is too low.

If we accept the results of the most careful physicists of our day, we may take the calorific value of one pound of good coal as equal to 7,500 Centigrade degrees.

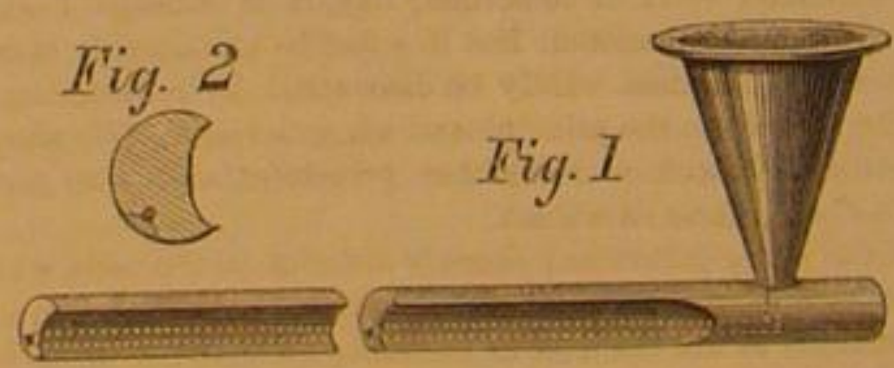
Two such pounds consumed in as perfect a steam engine as we can construct, gives us an indicated horse power of 33,000 foot-pounds per hour, so that twice 7,500 units, or 15,000, in this case, will produce in an hour an effect equivalent to 33,000 × 60 minutes, or 1,980,000 foot-pounds. One unit at atmospheric pressure of 14·706 pounds will then represent 132 foot-pounds.

Reducing the pressure to zero, we obtain the equivalent of 1,931·192 foot-pounds for each unit of heat. Had the calorific power of 1 pound of coal been 6,000 units of heat, our equivalent would have been 1,838·25; if 8,000 deg., 2,426·32. The average would be 2,065 foot-pounds. This result we *practically* obtain every day with engines which we know to lose 30 per cent of useful heat. Adding this 30 per cent to our equivalent, as above, we obtain 2,684·5 foot-pounds, as the real equivalent of one unit of heat as exhibited by the working of the modern steam engine.

SELF-LUBRICATING AND SELF-CLEARING DRILL.

Boring deep holes in metals, especially when the hole is of very small diameter, and it is necessary to have it drilled straight and true, is not always an easy matter. In boring pistol and rifle barrels, for instance, nearly as much time is employed in in removing the drill, clearing, and lubricating it, and replacing the barrel and drill, as in the drilling itself. The drill shown in the accompanying engraving was brought to our notice by Wm. A. Chapin, of White River Junction, Vt., and introduced by him into the U. S. Armory, at Springfield, Mass., and is intended to obviate the difficulties alluded to, and save this otherwise wasted time.

Fig. 2 Fig. 1



The drill is, as seen in Fig. 1, a "pod" drill, milled to crescent form, in transverse section, the milled semicircular score being for the reception of the chips. Throughout its whole length it has a channel, seen in both figures, but more plainly in Fig. 2, that terminates at the cutting end, or point, and near the other end connects with a funnel to receive the oil or alkaline water, which acts as a lubricant. This score is milled or planed in the body of the drill, and covered with a piece of sheet steel, held in place by soft solder. Fig. 2, the enlarged cross section, shows this arrangement.

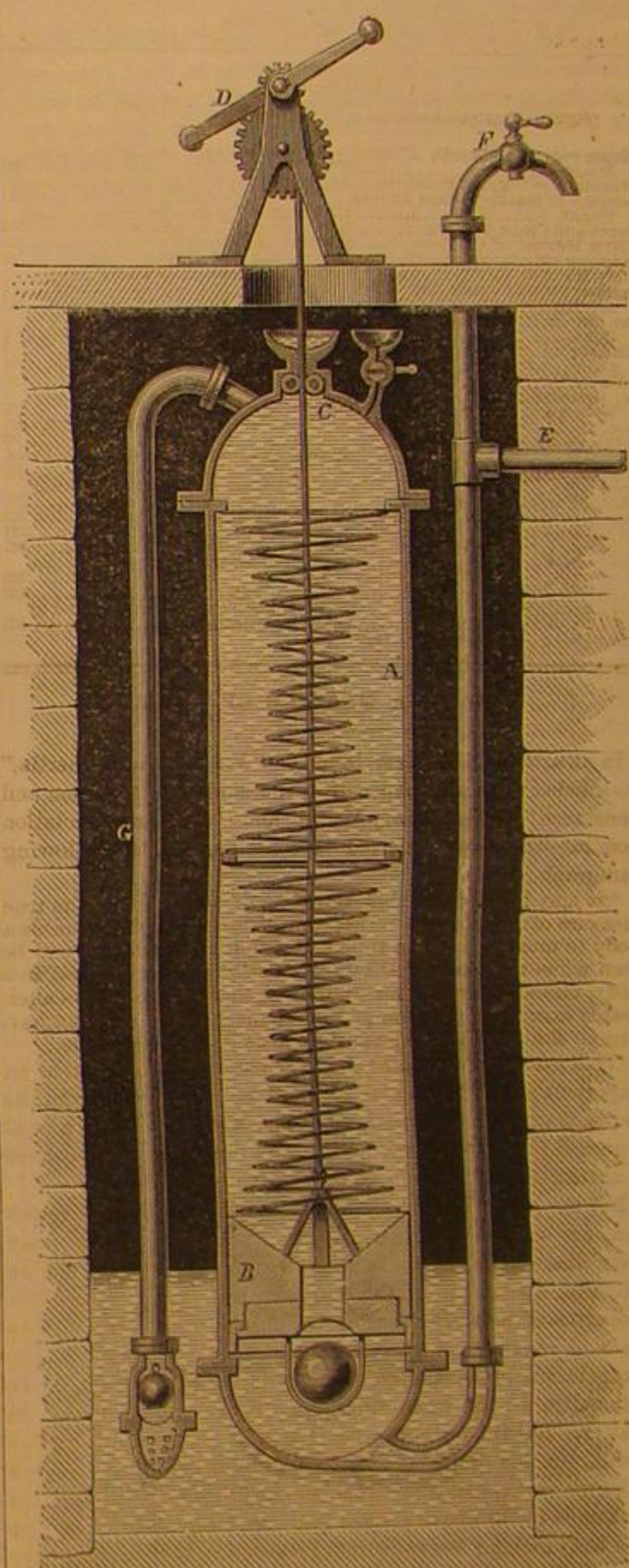
At the cutting end of the drill, the heat, caused by friction, will be greater than at any other point, and if the drill is used horizontally, the oil will be thinned and find its way to the point. If, at any time, the oil passage should become clogged, the hand end may be opened and a wire introduced for its cleansing. This end may be closed by any simple plug that may be readily removed for the purpose. This clogging, however, rarely occurs.

Tunneling Street Crossings.

Engineering speaking of the proposition to construct either bridge or tunnel crossings on the crowded streets of London, condemns both plans. Arguing against bridges, *Engineering* says: "We have sufficient experience, from a lengthened trial of the overhead bridge spanning the most crowded portion of Broadway, New York, that such a system of street crossings is of but little service; decrepit persons were unable to use it, business people too hurried, ladies were assisted over the street by the police, and the bridge was scarcely employed, save by idlers, while the only one who derived profit from it, till it was removed a few months ago, was a neighboring photographer. And if a bridge has proved itself objectionable in a situation where, of all others, a bridge should have proved itself most beneficial, a subway would be still more useless and objectionable." We certainly cannot see the force of this reasoning. In no single respect, but that of being on a different level from the street, is a subway like a bridge. But while the bridge must be high enough to allow vehicles and loads of all sort to pass under it, and its ascent and descent is consequently wearisome, the floor of a tunnel need not be more than eight or nine feet from the upper surface of the roadway. We have yet to hear any valid or even plausible objection to tunneled street crossings.

KOCH'S COMBINED AUTOMATIC LIFTING PUMP.

The object of this pump is to produce a continuous flow of water, by means of mechanical appliances brought into action by occasional exertion of force storing up power, for the time when required. The intention is to concentrate a force by a moment's application of physical power, to develop gradually into a power extending through a period much longer than that required for condensing or compressing it.



The cylinder, A, is suspended in a well, tank, or cistern, having inside it a piston, B, to which is connected a wire or other rope by which it may be lifted. This rope passes between rollers, C, at the top of the cylinder, made of elastic or flexible material, thus forming an air-tight joint, or packing. It is wound around a barrel by means of the double crank, D, and pinion and gear at the top of the well or cistern, or at any convenient point in the building. Connected with the piston is a series of spiral springs two or more in number, guided by means of diaphragms fitting the interior of the cylinder, but not necessarily air or water tight. In raising the piston, B, of course these springs must be compressed, and this compression is the means for furnishing the power necessary to re-depress the piston by their resilient force, and thus raise the water. Suppose the cylinder be, as represented, filled with water, the piston raised, and the springs contracted; it is evident, if pipes E and F, are furnished with cocks and they are closed, no air could enter the cylinder from these sources when the piston was raised, and a consequent vacuum would be formed under the piston. Then water passes from the pipe, G, to above the piston and rushes down through the cylinder and the central hole in piston, B, up through the upright pipe, to be delivered by the pipe, E, or the pipe, F. The descent of the piston will be governed entirely by the water drawn through these pipes, so that the amount of water that can be drawn, before again contracting the spring, is limited only by the capacity of the cylinder.

Patent pending through the Scientific American Patent Agency. Further information may be obtained by addressing Christian H. Koch, at Davenport, Iowa.

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Contents:

(Illustrated articles are marked with an asterisk.)

TIME AS A MEASURE OF FORCE.

In an article in our last issue, on "Vis Viva and Inertia," we alluded to an able paper upon the subject of "Motion and Resistance," by Prof. Henry Morton, and made a brief quotation from it. The paper referred to contains, also, the following paragraph:

"It may be objected that the time of action is not the true measure of a force, but rather the distance which it causes a body to move in a given time. But that this is not so, will be seen when we consider that any velocity once implanted in a body, needs no force to maintain it, so that all the motion afterwards executed by reason of that element, is a clear gain having no equivalent of expended force as its representative."

This paragraph contains the very partial enunciation of an important and fundamental law, and as it is evident, from the connection, that the author, when speaking of force as a positive, also considers with it its negative, resistance, his position is unassailable. Distance is not a measure of motion.

But the real meanings of the correlatives, force and resistance, are but dimly comprehended by many even who essay their discussion. Force is regarded by many as a hidden property, distinct from the ordinary and easily discernible properties of matter as seen in its aggregated state. Others seem to regard it as an exterior and occult influence, which compels matter, but does not reside in it. Others, more rationally, we think, consider it as being simply motion of matter. But the latter is true, if true at all, only in a limited sense. In this limited sense force implies resistance; cannot exist without resistance. This is evident from the illustration contained in the above extract from Prof. Morton's paper, that is, a body moving forever without resistance, from a previously applied force. It is, then, only while motion is imparted from masses to masses, from molecules to molecules, from atoms to atoms or molecules, from molecules to molecules or atoms, from atoms or molecules to masses, or from masses to atoms or molecules, that motion becomes a force. If motion is recognized, in this limited sense, as force, the true idea of resistance is expressed by saying that a body, by impact, loses motion or imparts it to masses, molecules, or atoms. In this view of the subject the relations of force and resistance exist together, and time is a measure of both, or either.

Momentum, amount of motion, expressed in the works on physics, by M_1V, which is the weight of a body multiplied by its velocity, is not an absolute expression, unless we establish a unit of velocity. The mathematical expression of a unit of velocity is found by dividing the entire number of units of distance by the number of units in the time required for a body to move through that distance. It is $(D \div T)$, in which D represents the distance, and T the time. It is at once seen that neither time (T) nor distance (D) is a measure of momentum (M V), when considered separately; and the momentum of a body, or its amount of motion, is a constant one for all times when velocity $(V = D \div T)$ is constant, and M is also constant.

So far as motion is concerned, considered simply as motion and not as force, time is no measure of it. As soon as a body begins to impart its motion, or, as is the common method of expression, "to overcome resistance," time alone may be a measure of the motion received (force), and the motion imparted (resistance), the equality of which has long been recognized by physicists in the expression, "action and reaction are equal." For if the entire amount of motion imparted and received be uniform during a period of time, the motion imparted during a unit of that time will be an exact measure of the whole motion imparted; and the motion imparted for a unit of time is only found by dividing the entire amount of motion imparted by the time.

The author of the article on "Vis Viva," in the *Chemical News*, from which we made an extract in our article on "Vis Viva and Inertia," in our last issue, seems to have reached a somewhat similar conclusion, when he asserts that, "as he understands 'vis viva,' it relates only to change in velocity, and does not apply to the maintenance of a uniform velocity after it has been once attained." Now, change in velocity is purely and simply the subtraction from, or addition to, the motion of a body—of motion considered as quantity—and as (if the views of the identity of motion and force be correct) this, of necessity, implies force and its correlative, resistance, we see how "vis viva" can only relate to *change of velocity*.

There is little doubt that the differences which arise upon topics like these, between those who attempt their discussion, originate more from the inefficiency of language than from the real views entertained respecting them. The language of scientific discussion should be cleared of many terms that now are only sources of embarrassment. Some of these may be noticed, more especially, in a future article.

THE BURDEN OF MEMORY.

Appleton's Journal contains in its first number a calculation, by Berthelot, the eminent French organic chemist, of the number of combinations which may be made of acids with certain alcohols. He says, if you give each compound, thus possible, a name, and allow a line for each name, and then print 100 lines on a page, and make volumes of 1,000 pages, and place a million volumes in a library, you would want 14,000 libraries to complete your catalogue.

The science of chemistry is perhaps the most striking example of the rapid accumulation of facts so characteristic of the present age. Hosts of investigations in every field of research are unearthing treasures of knowledge and adding them to the accumulated scientific wealth of the world. The burden which the memory is called upon to bear is already so heavy, that it could scarcely be possible for any man, however gifted by nature, to carry with certainty, those pertaining to any one department of science, even though his entire life were devoted to it.

This fact explains the increasing demand for works of reference. Encyclopedias, hand-books, compilations of tables, and various and multiplied helps to memory abound; new books of like character are constantly issued, and those which already exist, need constant revision, to keep pace with the march of discovery.

It is quite evident that only a small fraction of the mass of facts can ever be stored up in any individual memory; the attempt to remember them would occupy thrice the years allotted to the life of mankind. If only part can be remembered, it becomes important to know what *ought* to be remembered, and what must be left to the works of reference.

While facts are almost numberless, principles are few. We can then, easily remember principles, and a knowledge of general principles is the key to research in books for facts we do not know; it is also the means whereby we can test the truth or falsity of the statements contained in such works. It would be strange indeed that errors should not creep into any extended work of reference; nay, it is strange that so few errors are committed. But if a fact be erroneously stated, the error will almost surely be discovered by considering it with reference to the principles which underlie it. We should therefore first seek to remember principles, and after them, just as many facts as we can.

But to every individual there is a choice in the facts which are to be remembered. Those which are of the most frequent application in his business or profession, are the ones he will be most likely to choose to remember, and with good reason. The life-long student (there are a few such still to be found) will choose such facts as he must frequently refer to in his studies. But facts to be most easily remembered, require thorough and careful classification.

To classify properly is however a task of skill—skill only acquired by a proper appreciation of the true end of all classification, namely, convenient reference. A business man classifies his notes, receipts, letters, etc., and places each kind of document in its proper pigeon hole; but this classification might be carried, so far as to utterly defeat the purpose it is designed to subserve. The pigeon holes might be so multiplied that a letter, or note, or receipt could be picked out of a single bundle sooner than a particular pigeon hole could be found among the entire number. Of course this is supposing a very extreme case, but it illustrates the point we wish to make, namely, that too much classification is as bad as too little.

A great many people have too many pigeon holes in their memories; more have too few; and a few, those who seem largely gifted by nature in power of memory, have neither too many nor too few; but no single man has room in his memory for everything. All must more or less have recourse to their book shelves.

A poor recourse it is in many cases. Down comes a huge volume, the title of which in broad letters on its back, shows that the fugitive fact we are after, is or ought to be within its covers. We turn to the back part to find the index, but we don't see it. Perhaps it is at the beginning. We hopefully turn over the leaves of the book to find it there, and discover nothing but a meager table of contents. We throw down the book in infinite disgust; if we have got to hunt two hours for that fact, unless it be of great importance, we conclude to do without it. We relieve our feelings by heaping anathemas upon the author, who maliciously thought to force us to read his entire work, before we should have our fact. We look for another book. Ah how different! A copious and carefully compiled index—by its help we unearth our fact, in less time than we occupied in searching for an index in the former one. Good! We dust it carefully and place it close to hand, and put the other away among the rubbish. As action is the soul of eloquence, so an index is the soul of a book of reference, and we admire both large souled men, and large souled books.

Books of reference are a necessity of the age. In fact all books on scientific or technical subjects, are books of reference and are more or less used as such, according to their worth. Authors should not lose sight of this fact. It is not enough that the subject should be ably handled, it should be so arranged that any passage may be found with the greatest facility. When this last and essential requisite is added to merit in other respects, it is a well-tempered, well-sharpened professional tool, which, if lost, or destroyed, is certain to be replaced, to the profit both of the one who manufactured, and him who uses it.

IDIOSYNCRACIES.

The peculiarities of constitution and temperament, and particular susceptibility to external impressions and influences, possessed by different individuals and included in the general category of idiosyncracies, have been a puzzle and a snare to the theoretical physiologist since the days of Galen. Such peculiarities are not confined only to the body, but are frequently to be detected in the mind.

The writer of this article is a descendant of families distinguished through several generations, both on the maternal and paternal side, for idiosyncracies, and is himself affected by a peculiarity to which his family physician can testify, and which will hardly be credited by other physicians. Opium in large doses is to him a cathartic. Very few cases of this peculiarity are to be met with. We once heard a distinguished professor of *materia medica*, assert in a lecture the possibility of this action of opium upon persons of peculiar constitution, unconscious that a living example of the fact was listening to his words. All idiosyncracies are of course remarkable as seeming exceptions to general laws, and there is nothing more so about the one mentioned than any other, except the rarity of its occurrence. We have met, indeed, with a physician of this city, who has known a similar case in Europe, but this is the only other case of the kind we ever heard of. On the whole we are inclined to think idiosyncracies much more common than is generally supposed, many escaping notice on account of their unimportant character.

One of the most common classes of idiosyncracies are those connected with eating and drinking. Almost every one is acquainted with somebody who cannot eat honey without subsequent distress at the stomach. Not quite so common are those who cannot eat the flesh of certain kinds of animals. A number of cases are recorded of those who could not eat mutton without poisonous effects. An instance of this kind once came within our personal knowledge. Supposing it to be purely the effect of imagination, the mutton was once smuggled into mince pies, usually made with beef, and thus disguised was eaten, by the person affected, with quite serious results. Violent pain in the stomach and sickness, followed by copious vomiting, in fact nearly all the symptoms of irritant poisoning succeeded the eating of the mutton in this case, and although the vomiting relieved the more distressing symptoms, the effects were felt for several days. Similar effects from eating mutton are recorded in the books.

Even the most mild, and apparently most harmless, articles of food may prove baneful to some people. Rice, cheese, eggs, and various kinds of fruits, as strawberries, oranges, and melons, have been known to invariably produce ill effects upon some peculiarly constituted individuals. There is scarcely one of our physical faculties that may not exhibit these idiosyncracies. Sight, smell, the sense of touch, and even hearing, may be thus perverted. How often we hear of certain sounds that they "set ones teeth on edge." We have read somewhere of women so sensitive to the effects of such sounds that the whistle of a thread drawn through stiff cloth in sewing was positively unendurable. Nay, there seem to be instances where deleterious effects are produced by commonly harmless objects, when their presence is recognized by no sense in particular. Instances of the latter kind are perhaps as well or better authenticated than any others. Effects of this class are generally connected with the presence of animals, as cats, rabbits, etc., the near approach of which is noxious to the persons affected, as is also quite frequently the touch of their furs.

All that we have stated is based upon the best authority and may be relied upon as perfectly credible. Now, how, we ask, disregarding such facts, can medicines be prescribed by rule, as is the too common custom, without occasionally evil, nay, even disastrous results?

We have often had opium prescribed in the ordinary full dose with the view to produce the ordinary, but exactly the opposite effect, invariably resulting to us from its use. We have seen the feet and limbs of a young lady whose skin is peculiarly susceptible to poisonous effects, so swollen and inflamed from the effects of mustard drafts, as to excite fears of the worst consequences. We have seen similar effects from the application to the skin of carbolic acid. We have stood by hundreds of sick beds and have seen numberless doses prescribed, and hardly ever have heard a physician ask how certain medicines usually effect the patients. As a consequence, we have seen patients completely prostrated by the action of drastic purgatives, in doses that would not perhaps have seriously injured the average patient. We have seen others completely narcotized by doses of morphine, that would only have quieted a cough in most; and so on to the end of the chapter.

We are well aware that book doctoring is held at its proper valuation by the leaders in the medical profession, and that to such, the really skillful, even the slightest peculiarity of temperament is not deemed unworthy of attention; but there are too many, far too many, who put all patients on the same plane, and confine themselves rigidly to one routine of treatment.

No less are idiosyncracies of mind and disposition to be regarded in imparting instruction to the young, or in our every-day dealings with our fellow men. Most mental peculiarities are easily discovered by the practiced student of human nature, and it as much our duty in our attempts to instruct and reform others, to avoid nauseating them mentally as it is that of the physician to avoid over-dosing those he is attempting to heal.

STEAM BOILER INSPECTION AND INSURANCE.

At a meeting of the Directors of the Hartford Steam Boiler Inspection and Insurance Company, held at their office in Hartford, March 31st, the following report of business done in the month of February, was read by the President: "Visits of inspections made, 180; number of boilers examined, 332; external examinations, 261; internal examinations, 84—while, in addition, 18 were tested by hydraulic pressure; number of defects in all discovered, 226; number of dangerous defects, 26; furnaces out of shape, 13; fractures, in all, 21—3 dangerous; burned plates, 20—2 dangerous; blistered plates, 53—2 dangerous; cases of incrustation and scale, 45; cases of external corrosion, 23—3 dangerous; internal corrosion, 3—1 dangerous; internal grooving, 6; water gages out of order, 6; blow-out apparatus out of order, 2—1 dangerous; safety valves overloaded, 22—3 dangerous; pressure gages out of order, 14—8 dangerous; boilers without gages, 1; cases of deficiency of water, 3. In the month's work four boilers have been found in such condition as to be positively dangerous, and beyond repair. These four have been condemned, and are being replaced by new boilers. In one of the cases of internal corrosion, noted above, an internal examination revealed to the inspector plates so badly weakened that upon sounding them with a hammer a hole was broken entirely through. This shows the importance of careful internal examinations. Many cases similar to the above have been found in localities where laws requiring annual inspections to be made are in full force. State and municipal inspection laws require only the hydraulic test to be applied; hence incrustation, scale and internal corrosion are defects which such inspections take no cognizance of.

"We must again revert to the subject of *overloaded safety valves*. Twenty-two have been found; while three were entirely inoperative—from excessive loading and neglect. One spindle was very crooked, and extra weighting was resorted to. In another the valve was corroded fast in its seat, and was raised with great difficulty. In another the fulcrum joint was corroded fast, and in raising the lever the connection was entirely broken out.

"Now, although a manufacturer may think he has a very careful engineer, and that inspection is hardly necessary, he must admit that a man whose business it is to thoroughly examine boilers, internally and externally, will discover defects which another would pass over. While many and serious defects have been discovered by the company's inspectors, no risk has been assumed except where the boilers have been put in good repair. Among the 2,500 boilers under the care of this company, slight damage has occurred to one in the city of Providence, during the month. Our inspector from this office visited the establishment at once, and made careful examination of the ruptured sheet; repairs were immediately made, this company assuming the expense."

DEATH OF JAMES HARPER.

The recent sudden death of James Harper, senior member of the celebrated publishing house of Harper & Brothers, of this city, has taken away from us one of our most honored and respected citizens. His death resulted from injuries received by being thrown from a carriage while taking a drive. His funeral, which took place upon the 30th of March, was largely attended by the most prominent citizens of New York; and was further honored by the closing of the different houses in the book trade throughout the city. He was, in many respects, a remarkable man, and his life was one long example of the beauty of all social and Christian virtues, combined with business and literary judgment, to a highly exceptional degree.

Applications of Steel Castings.

A few days ago we saw a number of specimens of steel castings imported by Philip S. Justice, of this city, which showed a degree of tenacity and ductility seldom found in steel forgings. The castings were of varying thickness, form, and weight, and had been subjected to forging, bending, percussion when cold, hardening, tempering, etc., all the tests that would be used to determine the toughness of the best wrought iron, and some that would be inadmissible with steel forgings. The result was wonderful. Cored castings were brought together under the hammer, and drawn out without showing any evidences of unsoundness. The castings showed no blow holes or evidences of want of homogeneousness, but were in all respects as sound as any forgings. They finished under the file or on the lathe elegantly. It is claimed they can be made as thin as one-sixteenth of an inch with facility. Their solidity may be conceived from the fact that hydraulic cylinders, unlined, of fourteen inches inside diameter, two feet ten inches long, and only two and a half inches thick, stand a test to which one of cast iron eight inches thick, would succumb.

These castings have been used in England for some time, but have only lately been introduced into this country. The applications of this method of working steel are numberless, or at least equal in number and similar in character to those of cast iron, and calculated to supersede wrought iron and steel forgings to a very great extent.

BEET ROOT SUGAR.

No. IV.

Technology.—Part I.

As a complete account of the various modern processes for manufacturing beet root sugar would fill several reasonably sized volumes, it will be impossible for us to exhibit them in all their multitudinous details in the pages of the Scientific American, where they would stand in the way of the publication of a large amount of useful and interesting reading matter of a more varied nature.

For this reason we shall have to confine ourselves to the illustration of the most recent and perfect methods of manufacture only, which we shall strive to do, as concisely as possible, without omitting any item of importance.

We will add, the specifications and detailed estimates for the establishment of a sugar factory, calculated to work an average of 150,000 lbs. of beet root per twenty-four hours, during a campaign of from four to five winter months, and corresponding in the United States to the average product of the cultivation of 500 acres in beets. This important subject has never, to our knowledge, been fully elucidated in any printed work on the making of sugar, and may be found of value to parties intending to start this branch of industry in America.

PRODUCTION OF STEAM.

Beet root sugar works consume a large amount of steam for driving engines which propel root-washers, hydraulic pumps and presses, pulpers, water pumps, centrifugals, etc. Steam also conveys the juice and sirups from one place in the building to another, and is the agent used for evaporating and boiling them.

The quantity of heating surface needed is generally estimated at about 250 square feet for every 10,000 lbs. of roots worked during 24 hours, or the H. P. is supposed to correspond to 50·8 lbs. of water evaporated per hour, or 6 lbs. of water for every square foot of heating surface of the boilers.

Practically, we have found that a well-managed modern sugar factory employing vacuum pans, both for the concentration of the juice and for its final boiling down, and capable of working 150,000 lbs. of beets every 24 hours, necessitates 120-H. P. boilers, and 17·216 feet of heating surface to the H. P.

The pressure of steam through the whole works ought never to exceed three atmospheres, or 45 lbs. to the square inch.

From the above, we derive the information that the steam department of a 500-acre beet root sugar factory and its cost in gold, will be as follows:

1. Three steam boilers of 40-H. P. each, with two internal pipes and one flue, calculated at 17·2 feet of heating surface per H. P., with fire boxes, grates, safety valves, gages, anchors, steam valves, H-pipes, etc., complete. Cost, $3,700.

2. Two steam drums, superposed over the boilers, with fittings complete, serving as reservoirs for the return steam from all parts of the works. Cost, $260.

3. One small 4-H. P. donkey engine, driving two feed pumps, each of which is capable of supplying a 120-H. P. boiler. Cost, $520.

The total valuation of the appliances for the production of steam in a 500-acre factory, is thus seen to reach $4,480.

WASHING AND PULPING OF THE BEETS AND EXTRACTION OF THE JUICE.

As soon as the works are in perfect readiness for a start, which will generally take place during the latter end of the month of September or during the month of October, the steam is "got up" in the boilers to 40 or 45 lbs. pressure, and the beets to be worked are at once, and regularly, carted in.

Each empty wagon or cart employed for the conveyance of the beets from the trenches to the factory is carefully weighed, and its number and weight noted. Every time this wagon reaches the factory with its load of beets, it is re-weighed, and the weight of the wagon being deducted from the total, furnishes at once the amount of beets carried in for consumption. The wagons and their loads are weighed on large platform scales placed on the roadside near the works. In this manner, during the whole campaign, an exact account is kept of every load of beet entering the works, and of every pound of beet consumed.

The quantity and percentage of sugar made is thus controlled, and in case of some fault in the processes of manufacture, it is at once made manifest. Much valuable information is also furnished by these data as regards the relative value of different fields or portions of land, and the amount of beets grown on them; information which may be made available during following seasons.

The beets as they are brought in are placed in piles alongside of the beet root washer. This is a long, cylindrical, slightly inclined revolving drum, constructed of parallel rods of iron, so distanced as to allow the water and small rootlets to pass between them without permitting the passage of large fragments or of small-sized beets.

This drum revolves in an iron tank, furnished below with a manhole door, which allows it to be occasionally cleaned out; this refuse being carted off as manure.

The proper speed for a root washer is from ten to twenty revolutions per minute.

The more water employed in washing the beets the better, but the supply of both roots and water must be as regular as possible.

Care must be taken that at the lower outlet of the root washer, where the beets fall on an incline plane, interstices be left wide enough for the superfluous water to escape before it reaches the pulper, where its presence would cause irremediable damage.

On leaving the root washer, or rather the incline below it, the beets are pitched into the jaws of the pulper, where they are seized between revolving cylinders, armed with spikes or or knife blades, which rapidly reduce them to a fragmentary form. These fragments pass into the pulper proper, which consists of a double revolving drum, driven by belting. It is constructed by *tightly* fitting into two circular iron end plates, alternate series of small saw blades with projecting straight teeth, and carefully-made wooden rulers 0·39 of an inch broad and 0·78 of an inch high. The saw blades are toothed on both edges, so that by reversing them, one side can be employed after the other has been worn off. The teeth are from 0·156 to 0·195 of an inch in length, and measure 0·078 of an inch from tip to tip in the same row. The thickness of the saws is about $\frac{2}{55}$ of an inch.

The steel of which these saws are made is tempered in such a manner as to cause them to be stiff and hard without being easily broken.

Immediately in front of the revolving drum, whose speed must be from 600 to 700 revolutions per minute, is placed a stout, finely-attached blade of steel facing the points of the saw teeth, and adjusted so nicely as to leave no holes or intervals through which any fragments of beet root would find their way.

This precaution alone prevents solid particles of beet from getting into the woolen sacks during the subsequent pressing, an accident which would be sure to be followed by the bursting of the sacks and wasting of pulp over the spots where the lumps are to be found.

A newly-set pulping drum always produces a rough pulp, in which a portion of the vegetable cells remain untouched; a consequence of this fact is that a larger quantity of juice is actually extracted from pulp made by a pulper which has had some usage, and whose teeth have become worn, than from a new one.

The pulp to be of good quality must be thin, and present no rough or angular "grain" when pressed between the fingers. A limit, however, exists to the advantageous divisibility of the beet root, which is reached when the teeth of the pulper are nearly worn away, and the pulp becomes "pasty," and will ooze through the meshes of the wool sacks when pressed, a circumstance attended with very serious consequences.

A small stream of water, regulated by a cock, is allowed to run constantly on the top of the drum, and to mix with the pulp, where it effects a partial maceration. The influx of this water is to be so regulated that the juice which is expressed will indicate 4·5 to 4·8 degrees of Baumé's densimeter.

The pulp is received in front of the pulper in a small reservoir.

At this point the further processes of manufacture may vary according to the system of extraction of juice adopted. Four of these are now practiced in Europe; they are as follows:

1. The use of powerful hydraulic presses.
2. The employment of centrifugal machines.
3. The method of maceration.
4. The diffusion process.

Without entering here into a discussion of the relative merits of these various processes, which, when well conducted, have in all cases produced the same amount of sugar from the same amount of beets, we shall simply state that the second materially increases expenses for the fuel used during evaporation, on account of the large quantity of water which has to be added to the juice, and that the two last processes need an amount of care and skill on the part of the laborers, which is difficult of attainment.

The system of extracting the juice from the pulp by means of hydraulic presses, worked by pumps driven by steam power, is simple, easily managed, and efficient. In order to effect this, the pulp is first put into bags made from the wool which grows on the bellies of sheep. These bags are 33 inches deep by 22 inches broad, and the quantity of pulp put into them is a shovelful, or a quantity which, when slightly flattened, will not exceed the thickness of a finger.

The sacks are piled up one over the other, separated by sheet-iron trays, and are first submitted to a preliminary pressure in a rapidly-working press, which extracts a large quantity of the juice contained in the pulp. They are then transferred to the hydraulic presses, where the remainder of the juice is squeezed out.

When working in the proper manner, the table of beet root sugar presses must ascend in from five to six minutes, and stop for several minutes before beginning to descend. Too rapid rising of a press destroys the sacks. If the pulp has been sufficiently pressed it will look and feel dry, and will not weigh more than 18 per cent of the weight of the beet root which produced it.

The expressed juice, both from the first press and from the hydraulic presses, is run through pipes connected with funnels or "chapels" into an iron reservoir united by means of a valve or cock, with an upright boiler, called a "*monte-jus*" which we shall describe in our next article.

Specifications and valuations in gold for the washing, pulping, and pressing department of a 500-acre beet root sugar manufactury are as follows:

1. One horizontal 20-H. P. steam engine for driving the root washer, pulping drum, the hydraulic presses, and two pumps capable of delivering 37,000 gallons per hour. Cost, $1,700.

2. The beet root washer, 12 feet long, with iron drum and cistern. Cost, $350.

3. One pulping machine, with double drum, and capable of working 150,000 lbs. of beets in twenty-four hours. Cost, $660.

4. One spare double drum for the above. Cost, $130.

5. Spare saws for same. Cost, $40.

6. One sack filler, or "*paletteur.*" Cost, $74.

7. One Lecointe press. Cost, $320.

8. Six hydraulic presses, with eight guides to each, two movable counterweights, twelve-inch pistons, and 40 inches stroke. Cost, $4,000.

9. One iron frame, with two hydraulic pumps, these alternate, with differential pistons, eccentric transmission of motion, and patent compensator, fitted to work the eight hydraulic presses. Cost, $1,200.

10. Six "returns," stops, and wrought-iron pipes for the hydraulic presses. Cost, $200.

11. Two sheet-iron gutters, and three large funnels or "chapels" for collecting all of the expressed juice. Cost, $150.

12. One "*monte-jus*" of a capacity of seventy-five cubic feet, with all its accessories, and a connecting reservoir of same capacity. Cost, $210.

13. Pulleys, belts, etc., for transmissions of motions to root washer, pulper, hydraulic pumps, etc. Cost, $520.

Total cost of washing, pulping, and pressing department of a factory which will work 150,000 lbs. of beet per twenty-four hours, will be $7,274.

VELOCIPEDE NOTES.

The velocipede has got into the highest court in England. A lower court has decided that it is unlawful for toll-gate authorities to charge toll for a velocipede; but the company against whom this decision was rendered, mean to carry the case up to the chief tribunal. The charge of toll was made under the clause empowering to charge for "a foot passenger driving a wheelbarrow."

It has also got into the magazines, into the theatres, and into the hearts of the sport-loving community so deep that it will take it a long time to get out. It has a language of its own, and a literature of its own, which is not confined to prose, but includes also rhyme if not poetry. Grave periodicals write dissertations upon it, humorous ones caricature it, the daily press tells very extraordinary yarns about it. For our part we simply endeavor to keep our readers posted upon its progress.

In Boston the municipal authorities have recently granted fourteen licenses for velocipede rinks.

Two new styles of velocipede, which conflict with no existing pattern, are reported from Worcester, Mass. One of these is to run entirely by friction and the other with common foot paddles.

Mr. Calvin Witty has just received the original velocipede—the one built by Pierre Lallement before he had received his patent. It is a good velocipede in every way and has a much better saddle than is manufactured to-day. Lallement was a machinist, and this velocipede proves that he was a good workman. From appearances Lallement has ridden it a good deal. As a curiosity it is very valuable to Mr. Witty.

A new style of velocipede was exhibited at Witty's school on Tuesday night. It is a wire velocipede, the wheels being formed of wire entirely. Small thin wire takes the place of spokes, and it is made strong on the same principle that makes a suspension bridge strong—each wire strengthening the others. It is exceedingly light, and there is a slight vibratory motion which is very pleasant; doubtless it would do exceedingly well on the street. When it was run last night upon the new spring floor which Mr. Witty has laid down, the spring was very great. It attracted much attention on the night spoken of.

The unreasonableness of prohibiting velocipedes from the public highways is thus satirically spoken of by the *New York Herald*:

"Man's own feet or crutches and a wheeled vehicle with a horse in front—these, it seems, must be the Alpha and Omega of locomotion in the city streets. A wheeled vehicle without a horse is a thing so preposterous to the eyes of aldermen that it must be forbidden altogether. Such is the experience of several cities, and our city promises to follow suit. Now, though the horse is favored by popular prejudice, a man may move his wagon with a mule, or a jackass, or a goat, or a dog; but he is not permitted to move it without one of these in front, or he will be fined twenty-five dollars. We recommend the sports to tie their tan terriers in front of the machine with a piece of pink ribbon, and go it on the same dodge adopted for the dummies, where an old blind horse trots in front of the locomotive within city limits. Although the aldermanic abdomen is a guarantee against any experiment of the Fathers on the velocipede, cannot some juvenile of aldermanic lineage convince the old fellows how ridiculous they are in endeavoring to prohibit what only needs regulation?"

WHEN the machine, or its parts, is beyond the operator's powers, the machine has usurped the place of its governor or manager. Every person running a machine should understand it, sufficiently at least to retain his natural superiority. If not, the machine is his master, which is reversing the order of nature.

ARE UTENSILS OF COPPER INJURIOUS FOR CULINARY PURPOSES?

Translated from the German "Aus der Natur."

Utensils of copper are held in high esteem by most ladies, because they form when well scoured, a kind of ornament to the kitchen. They do not however, take into consideration that food may be poisoned when cooked therein. It has been stated, though scarcely to be believed, that articles of food containing acids may be prepared in copper vessels without any injurious effect, if they be not allowed to remain in such vessels any length of time. This opinion has even been sustained by men of science, who maintain that the action of the acid upon the metal is prevented, because the vapors which are constantly generated in cooking prevent oxidation taking place. Recent investigations, however, have proved beyond doubt that this supposition is incorrect. Pleischl, in Vienna, showed that cabbage, fresh and dried plums, etc., absorb a quantity of copper sufficient to cause injurious effects within one hour's boiling in pans made of this metal. Meat also, because of the acids, it contains, is acted upon by copper. This is also the case with water when it contains chloride of sodium or salt, which is rarely ever lacking in spring water. Copper is also readily dissolved by oil. In placing a drop of oil upon polished copper, it will be seen that the oil soon assumes a dark bluish green color, which change is due to the fact that the oxide of copper formed, has combined with the fatty acids contained in the oil. The power of solubility is, of course, considerably increased when the oil or lard has previously been subjected to the action of heat.

Quite recently Dr. Wald asserted in a German periodical that copper is not poisonous and the objection to utensils of copper therefore unfounded. He asserts that no case of poisoning by salts of copper is recorded! The doctor certainly must be unacquainted with Orfila's toxicology or similar works.

Copper, as long as it remains metallic, is indeed not always injurious to the system. Instances are known where individuals have swallowed copper coins and discharged them again without the least injury, and Drouard has administered nearly one ounce of finely pulverized metallic copper to a dozen dogs, without observing any case of poisoning. Still, Orfila himself relates that an individual in swallowing copper powder was seriously affected.

It is also well known that braziers and electrotypers are often subject to a peculiar disease called copper colic. Its symptoms are fever with violent pains in the bowels. The sickness itself consists in inflammation of the stomach and the intestines, and is produced by the introduction of finely divided copper into the system. The late Professor Runge also mentions that a dealer of the oxide of copper, in Berlin, was unable to obtain laborers for collecting and packing it, because of the illness it occasioned among them.

Orfila relates several cases of poisoning which were produced by salts of copper. Five children, of from three to eleven years of age, were taken ill after eating bonbons which had been colored green by the vessel in which they were prepared. Drouard suffered three days from colic and diarrhea after having eaten a "ragout" prepared from the wine of a cask of which the cock was found to be oxidized.

Orfila says that a dog died in less than three hours from the effects of a dose of verdigris not exceeding fifteen grains. A small one died in sixty-five minutes from a dose of sulphate of copper of forty grains. Death, also, took place invariably when the sulphate of copper was applied upon wounds.

Renne in his treatise on judicial chemistry also relates a number of cases of poisoning by copper.

We admit that cooking utensils of copper very rarely cause sudden death; but are they, nevertheless, to be called harmless? If the copper taken up by food acts but slowly, it does not act with less certainty, no matter whether this may at the time be positively proved or not. That utensils of copper may be dangerous in certain cases seems to be known to cooks, for we have never found any who used copper pans for frying omelets.

The distinguished French chemist Chevallier who treats upon this question in a memoir recently presented to the French Academy of Sciences has been led to somewhat different conclusions from those of Dr. Wald. After having quoted numerous instances of poisoning caused by food prepared in copper pans, concludes as follows: "All the facts which have come to my knowledge, prove positively that the use of utensils of copper for culinary purposes is dangerous, and that it is unwise to say that copper and its salts are not injurious, or that cooking utensils of this metal are harmless." Chevallier suggests that copper ware employed in the kitchen should always be coated with tin. In Paris, and the department *de la Seine*, this is already the case, but he demands that the respective decree be made a law in all the departments, or that the mayors of the cities direct attention to the great importance of tinned copper. We find that in Sweden, though copper is one of the principal products of that country, the use of copper vessels is prohibited for the preparation as well as for the preservation of food. In 1774, the *chef de police*, in Paris, forbade the dealers of milk to carry the same in vessels of this metal, and even before that date a large establishment was founded in that city for the making of iron utensils for culinary purposes. At first, however, they met with little success, but gradually they came more into use. In 1790 copper vessels were made, the inner surface of which were silverplated. It was also, recently proposed to silverplate iron.

The silverplating of copper, aside from the expense, cannot be recommended. The silver, because of its soft nature, is easily detached, leaving the copper surface exposed, and wherever this is the case the copper is more readily attacked than otherwise. The reason for this is found in the electro-chemical action which occurs. Cast iron vessels with enameled surfaces inside are better for culinary purposes. The enamel, however, should be free from lead.

The presence of copper in liquid food is readily detected by holding in it a knife blade for about ten minutes. If copper is present, it is thrown down upon the iron and can easily be recognized by its red color.

We find it stated in various cook-books that in order to restore the green color of pickled cucumbers, a copper coin should be dissolved in the vinegar. The evil effect of such a process must be apparent to all.

Chrome Green.

Oxides of chrome are prepared either in the dry or wet way; obtained thus, they vary from greenish grey to a more or less deep greenish yellow. They generally have neither brilliancy nor freshness. It is possible, however, to produce green oxides of chrome which are not devoid of beauty. One of the most intelligent chemists of the commercial world, M. Casthelaz, has, conjointly with M. Leune, prepared a chrome green, which is justly styled imperial green. This coloring matter of a superior brilliancy is obtained exclusively by the wet way. The process consists in slowly precipitating chrome salts by treating them with hydrated metallic oxides, insoluble, or but slightly soluble, in water, or by hydrated metallic carbonates, or hydrated metallic sulphides, or, again, by other salts of weak acids, which easily leave their bases; the action is only produced progressively, and the oxide of chromium is precipitated in the hydrated form; the color of the compound is magnificent, of a deep emeral green. For this preparation, it is convenient to adopt economical reagents, such as gelatinous alumina, oxide of zinc, carbonate of zinc, sulphide of zinc, etc., whose price is reasonable. The same result may be obtained by treating a chrome salt with the non-alkaline metals, which have a sufficient affinity to unite with acid of the chrome salt and precipitate the oxide. Iron and zinc will be more particularly used, as they are cheaper. It is necessary to select from among the metals, with their oxides and salts, those which, with the acid of the chrome salt, give soluble salts, as they should be removed by washing. If recourse is had to reagents forming, with the acid of the chrome salt, insoluble salts, it is only in order to modify the color and composition of the chrome precipitates and of the green color thus formed. As to the magnificent imperial green color obtained by M. Casthelaz, it possesses properties which will enable manufacturers ultimately to renounce the justly condemned and dangerous copper and arsenic greens. The use of the imperial green removes all danger from insalubrity; it is an impalpable substance, of perfect tenuity. It is believed that this property will cause the new green to be adopted for printing on stuffs, and for other purposes. The oxides of chrome known up to the present time, and generally obtained in the dry way, cannot, by pulverization, attain to the degree of fineness of the imperial green. It is expected that this substance will have great success in oil painting, colored papers, colors, and artificial flowers, printing, lithography, perfumery, and soap manufacture, as well as in the making of glass and in the ceramic arts.—*Moniteur Scientifique.*

NEW PUBLICATIONS.

APPLETON'S JOURNAL OF LITERATURE, SCIENCE, AND ART.

The first number of this new candidate for popular favor has made its appearance, and its mechanical execution is well calculated to invite the reader to "a feast of fat things," but we confess to a disappointment in the literary branch. Victor Hugo's new novel opens in a somewhat disjointed style, but the fame of the man assures us that the tale will progress with an increased power and interest; the opening chapters being the rougher work, which always precedes the more symmetrical structure. The general contents lack somewhat of that spicy flavor which necessarily must enter into all journals of a popular character; but the editorial department may improve with a little more experience.

THE ARCHITECTURAL REVIEW. Edited by Samuel Sloan, Architect. Published by Claxton, Remsen & Haffelfinger, Philadelphia.

The number for April contains a good article upon "Architecture in America, "The Cathedrals of England," beside several practical articles and illustrations of value to all who take an interest in the development of architectural taste in our country.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

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

☞ *All reference to back numbers should be by volume and page.*

A. J. S., of La.—Your inquiries relative to caloric engines will be found answered in our description of the Roper improved hot air engine, to be illustrated in our next issue, No. 17 current volume.

W. H., of Pa., is running a quarter-turn belt, 60 feet long and 16 inches wide, from a 48-inch pulley at the bottom to a 52-inch pulley above. It does not run well and binders are necessary. A 12 inch belt of the same length ran well for a time but subsequently required binders. He asks if there are any cases known where quarter-twist belts of these lengths and widths have run well without binders. We know of no such cases. In our practice we never attempted to run a belt of either 16 or even 12 inches wide on a quarter turn, and if compelled to do so would have insisted on a greater distance between shafts than that in this case—less than 15 feet. Where the limit is between widths of belts and distances between points for the quarter turn we are unable to determine. The millwright usually relies much upon his own judgment.

H. B., Jr., of Canada.—If an invention has been patented abroad, that will not prevent the original inventor from patenting it here—unless the invention has not gone into public use before the date of his application in this country; but the term of his grant here, in such case, would be limited to the expiring of the term for which letters patent were first issued to him abroad for such invention. If a patent exists in a foreign country, that fact would debar the granting of a patent here to another inventor, unless he could show that he made his invention before the date of the foreign patent.

H. W. P., of Vt.—Carbolic acid will not remedy the odor arising from concrete walks, in which coal tar is an ingredient.

R. & B., of Conn.—The knitting machine to which you refer is we believe more generally used than any other.

L. F. M., of Mass.—The "Patent Claims" are now issued weekly, in pamphlet form, by the Patent Office, at $3 per annum.

S. A. H., of Conn.—Gumbridge & Co., to whom you refer, have been dealt with according to law. They were humbugs, no doubt.

H. H., of N. J.—There is no particular degree or dividing line that marks the difference between hot and cold, warm and cool. It is a mere matter of sensation.

H. C., of Pa.—We cannot admit any further discussion of the subject into our columns. The subject is stale, flat, and unprofitable.

D. T. Jr., of Pa.—We recommend you to get the "Silver Sunbeam" as the best work for you on photography.

S. F. M., of Ill.—Small pieces of brass can be melted in a sand crucible with a coal fire, but the crucible must be kept covered. You would be likely also to lose a large portion of the zinc. The best way to use up scrap brass is to melt it in with new brass, putting it in with the zinc after the copper is melted.

C. E. H., of Iowa.—The researches referred to as more recent than those of Joule, Rumford, Tyndall, etc., in the article entitled, "Waste and Economy of Fuel," are those of Auguste Langel, Victor Delacour, Hirn, Zeuner, Bede, Emile Martin, and Scholl, and other able engineers, including the author of the article in question.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

Recent American and Foreign Patents.

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

Scroll-Sawing Machines.—August M. Schilling, Chicago, Ill.—This invention has for its object to furnish an improved scroll-sawing machine, which shall be so constructed and arranged that holes may be sawn with facility and accuracy, without its being necessary to stop the saw to introduce the material to be sawn.

Broadcast Seeder.—Matthew Sackett, Monticello, Iowa.—This invention has for its object to furnish an improved broadcast seeder, designed especially for sowing timothy, clover, and other small seeds, and which be simple in construction and convenient in use.

Corn Planter.—Peter Rogers, Sharon, Ohio.—This invention has for its object to furnish an improved machine for planting corn, which shall be simple in construction, reliable and accurate in operation, and convenient in use; being so constructed and arranged that the dropping device may be readily thrown out of gear, allowing the machine to be turned or backed without dropping the corn, and which may be turned in a small space.

Stovepipe Shelf.—John P. Sherwood, Fort Edward, N. Y.—This invention has for its object to furnish an improved detachable and adjustable shelf for attachment to stovespipes, which shall be simple in construction, and easily attached, detached, and adjusted.

Raking Attachment for Reapers.—Charles Barns, Oskaloosa, Iowa.—This invention has for its object to furnish an improved raking attachment for reapers, which shall be so constructed and arranged as to take the grain, as it crops from the cutters, and deliver it to the binders or upon the ground, as may be desired, and which shall, at the same time, be simple in construction and effective in operation.

Horseshoe Nail Clincher.—E. E. Fisher and William H. Mack, Indianola, Ill.—This invention has for its object to furnish a simple, convenient, and effective instrument for turning down and clinching horseshoe nails, so as to obviate the necessity for the use of the rasp, hammer, and clinching iron, while doing the work neater and better.

Cultivator.—John Powell, Sullivan, Ill.—This invention relates to improvements in cultivators, or gang plows, and has for its object to provide a more simple and convenient arrangement of means for vibrating the plows laterally, adjusting than to vary the distance apart, and to govern their depth of cutting.

Soldering Apparatus.—Conrad Seimel, Greenpoint, N. Y.—This invention relates to a new apparatus for soldering the upper and lower edges of sheet-metal cans of cylindrical, prismatic, or other shape. It consists in providing an adjustable cover for the annular or other vessel in which the solder is kept, so that by forcing the said cover down, by means of suitable levers, the solder will be forced into the soldering pan, wherein it will rise to a suitable desired hight to surround the edge of the can to be soldered. When the levers are released, the covers will be raised by spring or weight, and will draw the solder back into the closed vessel in which it is protected from the injurious influences of the air. The soldering pan is endless, either round, square, or oblong, or of other suitable form, according to the shape of the box to be soldered.

Combined Knife and Fork.—Arthur W. Cox, Malden, Mass.—The object of this invention is to provide a combined knife and fork, better adapted for the double use than any now made, and intended more especially for use by persons who have but one hand.

Adjustable Reamers.—Henry James, Hudson, N. Y.—This invention relates to improvements in adjustable reamers, whereby it is designed to provide an improved arrangement of two or more cutters, upon a stock to be adjusted by screwing a nut forward and back upon the shank of the stock.

Machinery for Ginning Cotton.—B. Dobson and Wm. Slater, Bolton, England.—This invention consists, first, in applying to saw gins, which are provided with one or two sets of saws, a treadle lever, by which the feeding hopper may be agitated to clear the teeth of the saws, and to discharge the seeds and impurities, so that, when such treadles are used, the hands of the operator may remain at liberty; secondly, in applying to saw gins which are provided with one or two sets of saws, a fan, and two perforated metal cylinders, in which a partial vacuum is formed by the fan, to withdraw dust and other impurities from the ginned cotton passing over said cylinders; thirdly, in applying to, and in the aforesaid perforated cylinders, stationary dampers, by which the action of the vacuum is destroyed on those parts of the cylinder which deposits the cotton upon a feed apron, or other suitable apparatus.

Self-locking Cover for Coal Holes, Scuttles, etc.—Morison Hoyt, Brooklyn, N. Y., and G. Van Cleef, New York city.—This invention has for its object to furnish an improved cover for coal holes, scuttles, hatchways, etc., which shall be so constructed as to fasten itself when dropped into place without the possibility of failure, and in such a way that the cover cannot be removed from the outside.

Paint Mills.—John A. Berrill, Waterville, N. Y.—This invention has for its object to improve the construction of paint mills, so that the ground paint may be more conveniently collected from the mill and guided into the receiving vessel.

Portable Fence.—Joseph Richard, Columbiaville, Mich.—This invention has for its object to furnish an improved portable fence, which shall be simple in construction, strong, and durable, easily put up, taken down, or moved from place to place, and which can be easily and readily repaired when required.

Horse Collar.—B. W. McClure, Wyoming, Iowa.—This invention has for its object to furnish a simple, convenient, and cheap horse collar, which shall be so constructed that it may be used without harness.

Corn Sheller.—S. S. Cole, Henryville, Ind.—This invention has for its object to furnish an improved corn sheller, which shall be so constructed and arranged as to do its work quickly and thoroughly, while, at the same time, it may be manufactured at small expense, and thus brought within the reach of all farmers, even those of limited means.

Brick and Mortar Hod.—E. B. Black, Joseph Hinkle, Jr., and T. S. White, Columbia, Pa.—This invention has for its object to furnish an improved hod for carrying brick and mortar, which shall be stronger, more durable, less expensive, and equally as light as, or lighter than the ordinary wooden hod.

Attachment for Adjusting Cords for Hanging Pictures, etc.—R. d'Heureuse, New York city.—This invention has for its object to furnish an improved attachment for cords for hanging pictures, glasses, and for other purposes, by means of which the cords may be easily and quickly taken up and let out, for adjusting the hanging of the suspended object, without forming knots in the cords or untying knots previously formed.

Foundery Flasks for Sugar Kettles.—George Walworth, Peekskill, N. Y.—This invention relates to a new and useful improvement in flasks for making certain kinds of castings, but which has more particular reference to the molding and casting of sugar kettles.

Combined Foot-stool and Foot-warmer.—Jacques Jacquet, Newark, N. J.—The object of this invention is to produce an apparatus for travelers and others, which shall at once serve as a convenient foot-stool, and also as a foot-warmer in winter.

Boiler Scraper.—Monroe Morse and Charles H. Morse, Franklin, Mass.—This invention relates to a new self-adjusting boiler scraper, which is composed of a bent plate having straight sides, so that all its edges will form cutting edges within the tube to be cleaned. Thereby quicker operation is obtained with simpler apparatus than with the devices heretofore used.

Hop House.—William Loofbourow, Fayette, Wis.—This invention relates to a new building for drying and storing hops; it being so arranged that the hops therein can be easily handled and conveniently conveyed in the building from the cooling to the drying, and thence to the storing room.

Whips.—Edgar Easton, Ashland, Ill.—This invention relates to improvements in the construction of driver's whips, having for its object to provide an improved means of securing the lashes to the handles or stalks. It consists in forming a knob on the end of the stalk and braiding the lash thereon in a manner to form a swivel connection.

Automatic Raker.—C. Lidren, La Fayette, Ind.—This invention relates to a new and useful improvement in the method of operating automatic rakers for reaping or harvesting machines, whereby the mechanism for operating such rakes is very much simplified.

Device for Practicing the Handling of Violins and Bows.—Stephen Upson, New York city.—This invention has for its object to teach beginners the manner of handling the bows of violins and equivalent instruments, and the mode of using the fingers and practicing the shifts on the fingerboard of the instrument without producing any noise, and without exposing valuable instruments to the risk of being spoiled by the practitioners.

Skate.—Moses Kinsey, Newark, N. J.—This invention relates to a new adjustable skate, which can be applied to larger or smaller feet, and conveniently attached and taken off. The invention consists, chiefly, in the application of two plates, which are pivoted to the front of the skate, and which extend to the rear of the same, they being adjustable at any angle to each other by means of a screw. These plates carry the front and heel fastening clamps, which are moreover laterally adjustable on them. The invention also consists in the use of adjustable wedge-shaped heel clamps, which are adapted to firmly secure heels of all sizes and shapes to the skate.

Combined Spinning Wheel and Churn.—Morgan A. McAfee, Talbotton, Ga.—The object of this invention is to provide an arrangement whereby a common spinning wheel may be economically and conveniently arranged for employment as a propelling medium for a churn; also to provide certain improvements in churns.

Car Coupling.—I. L. Vansant, Glasgow, Del.—The object of this invention is to provide a simple, cheap, and effective automatic car coupling, constructed so as to avoid the use of springs of any kind.

Water Elevator.—Charles F. Woodruff, Newbern, Tenn.—This invention is an improvement upon the devices patented by the same inventor February 4th and September 15th, 1868, and consists in a combination in one machine of the main features covered by said two patents, thereby producing a more simple and permanent, and less expensive water elevator than either of the old ones.

Breech-loading Firearm.—Wm. Golcher, St. Paul, Minn.—In this invention, by moving a single lever, the breech of the barrel is thrown up, the gun cocked and held in that position, and the old cartridge shell retracted; by returning the lever to its original position, the barrel is brought down to its proper position for firing, and the gun is left cocked and instantly discharged. The whole apparatus is exceedingly simple, cheap, and not liable to get out of order, and its use will enable the gun to be fired much more rapidly and with less labor than heretofore.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING MARCH 30, 1869.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

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A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from .... $1 *upward, but usually at the price above named.*

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88,261.—Reversible Knob Latch.—Alonzo Aston (assignor to Russell and Erwin Manufacturing Company), New Britain, Conn.

88,262.—Screw Machine.—E. A. Bagley, Worcester, Mass.

88,263.—Mechanism for Connecting Horses to Vehicles.—Daniel Belcher, Easton, assignor to himself and Alvin Colburn, Lynn, Mass.

88,264.—Edge Plane.—Charles P. Bigelow, Clinton, Mass.

88,265.—Mucilage Brush.—Douglas Bly, late of Macon, Ga.

88,266.—Washing Machine.—Jacob Brinkerhoff, Auburn N. Y.

88,267.—Machine for Fitting Felloes to Wheels.—Frederick H. Brinkkotter, Callahan's Ranch, Cal.

88,268.—Bobbin for Spinning Machine.—Wm. M. Brisben Philadelphia, Pa.

88,269.—Last.—Thomas Bullivant, Newark, N. J.

88,270.—Hay Spreader.—Hiram M. Burdick, Ilion, N. Y.

88,271.—"Tinkers' Pot."—Gustav Burkhardt, Homer, Ill.

88,272.—Cistern Top.—T. M. Bush, Hastings, Mich.

88,273.—Fastening for Breast Pins.—Calvin G. Cahoone, and Bela E. Brown, Providence, R. I. Antedated March 15, 1869.

88,274.—Car for Brick Dryers.—Cyrus Chambers, Jr., Philadelphia, Pa.

88,275.—Garden Cultivator.—James F. Chapman, Newton, Iowa.

88,276.—Welted Seam-finishing or Reducing Machine.—John H. Cole, North Bridgewater, Mass.

88,277.—Dumping Wagon.—John Craig, San Francisco, Cal.

88,278.—Steam Engine.—Archibald C. Crary, Utica, N. Y.

88,279.—Clamp Bar for Holding the Cutters of Mowing Machines while being Ground.—Munson C. Cronk, Auburn, N. Y. Antedated March 19, 1869.

88,280.—Gang Plow.—Artemas Davison, San Leandro, Cal. Antedated March 20, 1869.

88,281.—Ironing Table.—Henry T. De Montigny, West Troy, N. Y.

88,282.—Sewing Machine.—Charles F. Dunbar, Erie, Pa.

88,283.—Channeling Tool.—George D. Edmands, Saugus, Mass.

88,284.—Railway Track.—Marmont B. Edson, New York city. Antedated March, 18, 1869.

88,285.—Application of an Electrical Current to Steam Boilers.—Moses G. Farmer, Salem, Mass.

88,286.—Velocipede.—Alonza Farrar, Boston, Mass.

88,287.—Vapor Burner.—Louis Fischer, Brooklyn, N. Y.

88,288.—Steam Generator.—Addison C. Fletcher, New York city.

88,289.—Churn.—John Geiger, Peoria county, Ill.

88,290.—Pneumatic Tooth Mallet.—George F. Green, Kalamazoo, Mich.

88,291.—Manufacture of Colors and Pigments.—Eberhard Harrsch, New York city.

88,292.—Water Wheel.—Orrin L. Hart, Millville, Wis.

88,293.—Wagon Brake.—D. Healey, Dansville, N. Y.

88,294.—Metallic Studding for Fire-proof Walls.—Isaac V. Holmes, New York city.

88,295.—Potato Digger.—John R. Hopper, Rochester, N. Y.

88,296.—Fruit Jar.—Daniel Hughes, Henry E. Shaffer and William S. Thompson (assignors to Henry E. Shaffer and William S. Thompson), Rochester, N. Y.

88,297.—Chair.—George Hunzinger, New York City.

88,298.—Device for Securing Bed Clothes.—George Inwood, San Francisco, Cal.

88,299.—Process and Apparatus for Making Iron and Steel.—Jacob Jameson, Philadelphia, Pa.

88,300.—Flea Powder.—Charles E. Jaycox, San Francisco, Cal.

88,301.—Portable Field Harrow.—Jacob D. Johnson, Tylersville, Pa.

88,302.—Railway Safety Switch.—Richard M. Johnson and Ezra Stiles, Bridgeport, Conn.

88,303.—Stump Extractor.—Wm. R. Johnson, Binghamton, N. Y.
88,304.—Horseshoe.—James Jorey, Westville, Conn.
88,305.—Dancing Motion for Toys.—James M. Keep, New York city. Antedated September 30, 1868.
88,306.—Clapboard Machine.—Oscar R. Kendall and Lemuel C. Kendall, Groton, N. H.
88,307.—Belt Fastening.—Gebhard Koeb and Louis Houcke, Springfield, Ohio.
88,308.—Washing and Wringing Machine.—John Lamb, Jeffersonville, N. Y.
88,309.—Plow Coulter.—John Lane (assignor to himself, C. H. Hapgood, William B. Young, and G. H. Laughton), Chicago, Ill.
88,310.—Heel for Boots and Shoes.—Rufus Lapham, Boston, Mass. Antedated March 11, 1869.
88,311.—Cultivator.—James R. Little, Galesburg, Ill.
88,312.—Horse Collar.—J. C. Mahaffey, Little York, Ill.
88,313.—Cooking Stove.—John F. Marvin and Samuel E. Vose, Milwaukee, Wis.
88,314.—Hay Spreader.—Nathan F. Mathewson, Barrington, R. I.
88,315.—Beehive.—T. F. McCafferty, Columbus, Ohio.
88,316.—Brick Kiln.—J. M. McCarthy, Canal Dover, Ohio.
88,317.—Tool for Shearing Sheep.—David McCarty and J. F. Beck, Tiffin Township, Ohio.
88,318.—Sash Lock.—George McGregor and George Voll, Cincinnati, Ohio.
88,319.—Gun Lock.—John C. Miller, Danville, Ky.
88,320.—Churn.—Morgan B. Miller, Peoria county, Ill.
88,321.—Apparatus for Composing and Exhibiting Groups of Card Pictures.—Sarah F. Mills, San Francisco, Cal.
88,322.—Stop Motion for Looms.—George E. Milroy, Lowell, Mass.
88,323.—Farm Gate.—A. T. Morris, Seal, Ohio.
88,324.—Aerial Car.—William Morrow, San Francisco, Cal.
88,325.—Drag Rake.—H. F. Morton, West Sumner, Me.
88,326.—Gas Purifier.—Peter Munzinger, Philadelphia, Pa.
88,327.—Extension Basket.—Addison Norman, Rochester, N. Y.
88,328.—Tremolo Regulator for Reed Musical Instruments.—Isaac T. Packard, Chicago, Ill.
88,329.—Grape Crusher and Stem Separator.—Turner C. Purington, Lincoln, Cal.
88,330.—Securing Ships' Hatches.—John R. Rich, Tremont, Me., assignor to W. J. Stockbridge, Gloucester, Mass.
88,331.—Machine for Making Joints in Table Leaves.—John Richards, Cincinnati, assignor to himself and J. N. Brittingnam, Columbus, Ohio.
88,332.—Milk Cooler.—Cyrus L. Sabin, Barnard, Vt.
88,333.—Journal Box.—E. W. Skinner, Madison, Wis.
88,334.—Harvester.—Wm. D. Slack, Lewisburg, Pa.
88,335.—Croquet Wicket.—Friend W. Smith, Jr., Bridgeport, Conn.
88,336.—Stump Extractor.—Henry Smith, 3d, North Chili, N. Y.
88,337.—Railway Car Coupling.—O. L. Smith, Providence, R. I.
88,338.—Safety Toggle for Watch Chains.—P. C. Smith (assignor to himself E. S. Dodge, and L. A. Kotzow), Providence, R. I.
88,339.—Farm Gate.—R. M. Smith, Lafargeville, N. Y.
88,340.—Animal Shearing Machine.—R. T. Smith and J. K. Priest) assignor to themselves, Wm. Earle, Jr., and J. G. Blunt), Nashau, N. H.
88,341.—Turbine Water Wheel.—W. H. Snyder, Phelps, N. Y.
88,342.—Car Coupling.—Henry Soggs, Columbus, Pa.
88,343.—Automatic Fan.—G. C. Steinhauer, Indianapolis, Ind.
88,344.—Shovel Plow.—U. T. Stewart, Fayette county, Tenn.
88,345.—Steam Generator.—Joel Tiffany, Albany, N. Y.
88,346.—Grappling for Anchors.—A. S. Trafton and T. J. Trafton, Portsmouth, N. H.
88,347.—Velocipede.—J. A. Vander Waag (assignor to T. Van Skelline, for one-half of said invention), Brooklyn, N. Y.
88,348.—Preparation of Aerated Drinks for Medicinal Purposes.—P. H. Vander Weyde and J. Matthews, Jr., New York city. Antedated March 18, 1869.
88,349.—Cabbage Cutter.—F. S. Vogel, and J. R. Albright, Lancaster, Pa.
88,350.—Weather Strip.—D. G. Walker, Oshkosh, assignor to himself, and G. H. Buckstraff, Winnebago county, Wis.
88,351.—Hinge.—Francis H. Walker, Boston, Mass.
88,352.—Portable Cooking Furnace.—R. H. Waldron (assignor to himself, and J. J. Flanders), Portsmouth, N. H.
88,353.—Method of Pressing Bricks.—W. G. White, Bedford, Ohio.
88,354.—Method of Making Inkstands, etc.—Henry Whitney, East Cambridge, Mass.
88,355.—Grate Bar.—Jas. Yocom, Jr., Philadelphia, Pa.
88,356.—Axle Box Bearing.—A. B. Allen (assignor to himself and J. D. Allen), Rutland Vt.
88,357.—Cheese Cutter.—S. R. Bailey, Bath, Me.
88,358.—Harvester Rake.—Chas. Barns, Oskaloosa, Iowa.
88,359.—Fire Extinguisher.—W. H. Bate, Medford, and G. F. Pinkham, Cambridge, Mass.
88,360.—Paint Mill.—J. A. Berrill, Waterville, N. Y.
88,361.—Brick and Mortar Hod—E. B. Black, Jos. Hinkle, Jr., and T. S. White, Columbia, Pa.
88,362.—Water Meter.—J. A. Bradshaw, and W. H. Brown, Lowell, Mass.
88,363.—Combined Harrow and Cultivator.—G. W. Bressler, La Fayette, Iowa.
88,364.—Railway Hose Bridge.—Jas. Burson, Yates City, Ill., assignor to James and Geo. B. Waterhouse, New York city.
86,365.—Take-up Mechanism for Looms for Weaving Irregular Fabrics.—Hugo Carstaedt, New York city.
88,366.—Velocipede.—J. M. Case, Worthington, Ohio.
88,367.—Corn Sheller.—S. S. Cole, Henryville, Ind.
88,368.—Spading Machine.—F. C. Cone, San Francisco, Cal.
88,369—Music Binder.—Lewis B. Covert, Brooklyn, N. Y.
88,370.—Combined Knife and Fork.—A. W. Cox, Malden, Mass.
88,371.—Piston Valve for Steam and other Enginery.—Robert Creuzbaur, Brooklyn, N. Y.
88,372.—Truss.—L. P. Dayton, North Buffalo, N. Y.
88,373.—Attachment for Adjusting Cords for Pictures, etc.—R. d'Heureuse, New York city.
88,374.—Cotton Gin.—Benj. Dobson and Wm. Slater, Bolton, England.
88,375.—Whip.—Edgar Easton, Ashland, Ill.
88,376.—Carriage Axles.—T. H. Elder, Chicago, Ill.
88,377.—Chuck.—G. B. Fairman (assignor to John Telford), Rochester, N. Y.
88,378.—Horseshoe Nail Clincher.—E. E. Fisher and W. H. Mack, Indianola, Ill.
88,379.—Apparatus for Discharging Coal.—E. F. Flood, Chicago, Ill.
88,380.—Metallic Boot Strap.—David Forrest (assignor to himself, and James Eldridge), Eastport, Me.
88,381.—Harvester.—W. F. Goodwin, East New York, N. Y.
88,382.—Combined Marker and Planter.—R. A. Green, Martinsville, Ohio.
88,383.—Mode of Lettering Signs, etc.—Alonzo Griffin, Meshoppen, Pa. Antedated March 25, 1869.
88,384.—Acoustic Stage.—Troutman Grob, San Francisco, Cal.
88,385.—Lock Nut.—J. W. Hilton, Bradford, Pa.
88,386.—Vault Cover.—Morison Hoyt, Brooklyn, and G. Van Cleef (assignor to themselves, and J. T. Lockhart), New York city.
88,387.—Wash Boiler.—P. H. Inman, and C. B. Withington, Janesville, Wis. Antedated March 27, 1869.
88,388.—Combined Foot-stool and Foot-warmer.—Jacques Jacquet, Newark, N. J.
88,389.—Adjustable Reamer.—Henry James (assignor to himself and W. H. Gifford), Hudson, N. Y.
88,390.—Clothes Pin.—Peter Johnson, Wauconda, Ill.
88,391.—Land Roller.—E. O. Jones, Brandon, Mich.
88,392.—Preserving Wood.—Chas. Karmrodt and Nicholas Thilmany, Bonn, Prussia.
88,393.—Skate.—Moses Kinsey, Newark, N. J.
88,394.—Harvester Rake.—C. Lidren, La Fayette, Ind., assignor to himself and R. Jackson.
88,395.—Hop Dryer.—Wm. Loofbourow, Fayette, Wis.
88,396.—Grain Separator.—Leonard Low, Peoria, Ill.
88,397.—Horse Hay Fork.—A. W. Lozier, New York city.
88,398.—Flood Gate.—Andrew Main, Delaware, Ohio.
88,399.—Churn.—Morgan A. McAfee, Talbotton, Ga.
88,400.—Horse Collar.—B. W. McClure, Wyoming, Iowa.
88,401.—Fence.—J. W. McCormick, Youngstown, N. Y.
88,402.—Ventilating Faucet for Discharging Liquids.—J. W. McKee (assignor to himself and John Gibbs), Brooklyn, E. D. N. Y. Antedated March 19, 1869.
88,403.—Cattle Tie.—Achille F. Migeon, Wolcottville, Conn.
88,404.—Bottle Corking Apparatus.—Giacomo [illegible]igliavacca, Napa, Cal. Antedated March 19, 1869.
88,405.—Boiler Flue Cleaner.—Monroe Morse, a d Chas. H. Morse, Franklin, Mass.
88,406.—Governor for Steam and other Enginery.—D. F. Mosman, Chelsea, Mass.
88,407.—Wind Wheel.—C. W. Palmer, Riga, N. Y.
88,408.—Cigar Ash-Holder, etc.—Adolph Philipp, Manchester, Great Britain.
88,409.—Cultivator.—John Powell, Sullivan, Ill.
88,410.—Soldering Apparatus.—Chas. Pratt, New York city., and Conrad Seimel, Greenpoint, N. Y.
88,411.—Tinman's Machine.—C. H. Raymond, Southington, Conn.
88,412.—Fence.—Joseph Richard, Columbiaville, Mich.
88,413.—Gang and Trench Plow.—J. G. Robinson, Springfield, Ill. Antedated March 23, 1869.
88,414.—Trench Plow.—J. G. Robinson, Springfield, Ill. Antedated March 22, 1869.
88,415.—Corn Planter.—Peter Rogers, Sharon, Ohio.
88,416.—Broadcast Seeder.—Matthew Sackett (assignor to self and John Filson), Monticello, Iowa.
88,417.—Scroll-Sawing Machine.—A. M. Schilling, Chicago, Ill.
88,418.—Washing Machine.—Adolph Schlingman, West Alexandria, Ohio.
88,419.—Soldering Furnace.—Conrad Seimel, Greenpoint, N. Y.
88,420.—Stovepipe Shelf.—J. P. Sherwood (assignor to himself and B. S. Burnham), Fort Edward, N. Y.
88,421.—Game.—A. G. Slagle, Memphis, Tenn.
88,422.—Water Wheel.—J. E. Stevenson, New York city.
88,423.—Device for Violin Practice.—Stephen Upson, New York city.
88,424.—Car Coupling.—I. L. Vansant, Glasgow, Del.
88,425.—Flask for Molding Kettles.—George Walworth, Peekskill, N. Y.
88,426.—Velocipede.—Edward Whitehead, Cincinnati, Ohio.
88,427.—Portable Fence.—H. C. Wilson, West Elkton, Ohio.
88,428.—Water Elevator.—Chas. F. Woodruff, Newbern, Tenn.
88,429.—Road Scraper.—Sidney Alderman, Stafford township, Ind.
88,430.—Lamp Shade.—J. B. Alexander, Washington, D. C.
88,431.—Device for Controlling Fluids under Pressure.—Jearum Atkins, Washington, D. C.
88,432.—Manikin, with Fœtus, etc., for Illustrating the Practice of Obsterics.—B. H. Aylworth, Oxford, N. Y.
88,433.—Extension Table.—Henry Bachman, Philadelphia, Pa.
88,434.—Apparatus for Distilling Spirits.—Eli D. Bannister, St. Louis, Mo.
88,435.—Iron Bedstead.—Jabez Bayston, Chicago, and Geo. W. Nicholson, Naperville, Ill.
88,436.—Breech-Loading Firearm.—Hiram Berdan (assignor to the Berdan Fire Arms Manufacturing Company), New York city.
88,437.—Ironing Machine.—Laurent Berenger, Paris, France.
88,438.—Car Brake.—A. A. Bliven, Jersey City, N. J.
88,439.—Mode of Preventing Corrosion in Metallic Caps.—L. R. Boyd, New York city.
88,440.—Car Coupling.—W. L. Braddock (assignor to himself and C. H. Minor), Boston, Mass.
88,441.—Spike for Overshoes.—G. W. Bradley, Weston, Conn.
88,442.—Refrigerator and Weighing Apparatus.—Ira Buckman, Jr., Williamsburgh, N. Y.
88,443.—Fertilizer.—S. A. Burkholder and G. W. Wilson, Bendersville, Pa.
88,444.—Drying Furnace and Oven.—J. K. Caldwell, Allegheny City, Pa.
88,445.—Hedge Fence.—S. N. Caldwell, Pilot Grove, Ind.
88,446.—Iron Bridge.—F. E. Canda, Chicago, Ill.
88,447.—Railway Car Brake and Starter.—R. R. Carpenter, Tippecanoe, Ohio.
88,448.—Printing Press.—Wm. H. Chandler, Winchester, Mass.
88,449.—Umbrella Cover.—J. C. Clime, Philadelphia, Pa.
88,450.—Spinning Mule.—B. C. Coldwell, Wyoming, Pa.
88,451.—Button.—Isaac Cole, New York city.
88,452.—Lathe.—Terrence Collins and Asher Castiel, St. Louis, Mo.
88,453.—Harvester.—G. T. Coolman and C. M. Young, Corry, Pa.
88,454.—Making Nails.—J. M. Cooper, Philadelphia, Pa.
88,455.—Wooden Pavement.—John R. Cushier, New York city.
88,456.—Mouse Trap.—A. G. Davis, Watertown, Conn.
88,457.—Sled.—Constantine de Bodisco, St. Petersburgh, Russia.
88,458.—Sign.—W. P. Delaplain, Peoria, Ill.
88,459.—Skate Fastening.—Patrick Dooley, Newark, N. J.
88,460.—Machine for Cutting Screws.—John Dougherty, San Francisco, Cal.
88,461.—Heel.—W. T. Downs, St. Louis, Mo.
88,462.—Sad-Iron Heater.—H. C. Drexel, Baltimore, Md.
88,463.—Toy Gun.—E. C. Edmonds, Albany, N. Y. Antedated March 25, 1869.
88,464.—Cotton Gin.—H. L. Emery, Albany, N. Y.
88,465.—Seeding Machine.—J. J. Esler, Belleville, Ill.
88,466.—Fertilizer.—L. S. Fales, New York city.
88,467.—Slate Frame.—J. H. French, Albany, N. Y.
88,468.—Refrigerator.—R. S. Godfrey (assignor to himself, Thomas Baner, and J. C. Hires), Philadelphia, Pa.
88,469.—Portable Fence.—W. P. Goff, Yorkville, Wis.
88,470.—Breech-Loading Firearm.—Wm. Golcher, St. Paul, Minn.
88,471.—Sash Balance.—Lewis Goodwin, Bangor, Me.
88,472.—Oven.—G. Y. Gray, Niles, Mich.
88,473.—Weather Strip.—A. J. Harmon, Charlestown, Mass., assignor to himself, W. H. Howland, and J. E. Hasseltine.
88,474.—Churn.—John Harper, Hillsborough, Iowa.
88,475.—Meter.—James Harris, Boston, Mass.
88,476.—Milk Cooler.—L. T. Hawley, Salina, N. Y.
88,477.—Horse Hay Fork.—G. W. Heath, Burlington, Pa.
88,478.—Washing Machine.—C. W. Hermance, Schuylerville, N. Y.
88,479.—Puddling Process for the Manufacture of Wrought Iron.—Chas Hewitt, Hamilton Township, N. J.
88,480.—Manufacture of Iron and Steel, and Furnace and Apparatus therefor.—Geo. J. Hinde, Wolverhampton, England, and T. C. Hinde, Ynispenllwch, near Swansea, Wales.
88,481.—Wagon Seat.—Edgar Hitt, Poundridge, N. Y.
88,482.—Picture Frame.—C. A. Hodgman, Tuckahoe, N. Y.
88,483.—Harvester.—G. M. Jackson, North Hector, N. Y.
88,484.—Apparatus for Heating and Separating Lime from Water.—S. F. Jackson and J. A. Davis, Eureka, Ill.
88,485.—Water Closet.—Henry James and Edward Drewett, Weybridge, England. Patented in England, Nov. 21, 1867.
88,486.—Plow Carriage.—W. L. Jeffries, Lancaster, Ohio.
88,487.—Device for Holding Plates of Glass.—Thomas Jones, New York city.
88,488.—Piano Lock.—R. J. Jordan, New York city.
88,489.—Trace Buckle.—E. M. Kinne, Cuba, N. Y.
88,490.—Combination Lock.—H. S. Leland, Mount Union, Ohio.
88,491.—Tide Power.—J. R. Leon, Havana, Cuba.
88,492.—Velocipede.—H. W. Libbey, Cleveland, Ohio.
88,493.—Machine for Making Bolts.—Edwin B. Locke Exeter, N. H.
88,494.—Insole.—R. O. Lowrey, Salem, N. Y.
88,495.—Steam Engine Governor.—J. A. Marden (assignor to J. H. and C. E. Abbott), Boston, Mass.
88,496.—Steam Engine Governor.—J. A. Marden (assignor to C. E. and J. H. Abbott), Boston, Mass.
88,497.—Steam Engine Governor.—J. A. Marden (assignor to C. E. and J. H. Abbott), Boston, Mass.
88,498.—Steam Engine Governor.—J. A. Marden and C. E Abbott (assignors to J. H. and C. E. Abbott), Boston, Mass.
88,499.—Sewing Machine.—J. N. McLean (assignor to himself and B. W. Lacy), Philadelphia, Pa.
88,500.—Cheese Cutter.—W. A. McDonald, Alna, Me., assignor to F. G. Cooker, for one half his right.
88,501.—Fastening for Curtains and Carpets.—Purches Miles, New York city.
88,502.—Adjustable Door Sill.—John H. Morris, Philadelphia, Pa.
88,503.—Loom.—Benjamin Oldfield and Edwin Oldfield, Norwich, Conn.
88,504.—Vault Cover.—G. H. Palmer (assignor to William Dale), New York city.
88,505.—Machine for Stretching Fabrics.—I. E. Palmer, Hackensack, N. J.
88,506.—Water Elevator.—William M. Palmer, Middlebush, N. J.
88,507.—Velocipede.—T. R. Pickering, New York city.
88,508.—Corn Planter.—N. M. Powers, Kirksville, Mo.
88,509.—Fireplace.—C. S. Rankin, Cincinnati, Ohio.
88,510.—Corpse Preserver.—A. G. Reed, Philadelphia, Pa.
88,511.—Harvester.—M. H. Ripley and W. N. Temple, Minneapolis, Minn. Antedated March 25, 1869.
88,512.—Steam Pump.—W. H. Roberts, Mauch Chunk, Pa.
88,513.—Folding Chair.—A. M. Rodgers, Brooklyn, N. Y.
88,514.—Mosquito Canopy.—Samuel Roebuck and John Roebuck, New York city.
88,515.—Paper Stock, Box Board, Roofing Paper, etc.—R. W. Russell, New York city.
88,516.—Fibrous-composition Slabs and Panels for Roofs, Floors, Walls, Tanks, and for other Purposes.—R. W. Russell, New York City.
88,517.—Valve of Steam-fiber Guns.—R. W. Russell, New York city.
88,518.—Fibrous-composition Tube.—R. W. Russell, New York city.
88,519.—Manufacture of Paper for Protecting Goods from being Injured by Moths, etc.—Robert W. Russell, New York city.
88,520.—Gas Cooler and Washer.—Richard Salter (assignor to himself and J. B. Davis), Cincinnati, Ohio.
88,521.—Construction of Safes.—Benj. Sherwood and Daniel Fitzgerald, New York city.
88,522.—Pianoforte Action.—D. H. Shirley, Boston, Mass.
88,523.—Portable Fence.—S. C. H. Smith, Belpre, Ohio.
88,524.—Manufacture of Steel Direct from the Ore.—R. S. Stenton, Brooklyn, N. Y. Antedated March 25, 1869.
88,525.—Machine for Sowing Grass Seed.—Henry Springer, Brady, Mich.
88,526.—Animal Trap.—J. J. St. Ledger, Philadelphia, Pa. Antedated March 25, 1869.
88,527.—Hat Ventilator.—C. C. Stremme, Austin, Texas.
88,528.—Street Letter Box.—Samuel Strong, Washington, city, D. C.
88,529.—Churn.—J. A. Tice, Windsor, assignor to T. C. South, Mattoon, Ill.
88,530.—Breech-loading Firearm.—A. L. Varney, Watertown, assignor to A. B. Ely, Newton, Mass.
88,531.—Breech-loading Firearm.—A. L. Varney, Watertown, assignor to A. B. Ely, Newton, Mass.
88,532.—Renewing Rolls for Printing, Calendering and like Purposes.—C. E. Wilson, New York city.
88,533.—Harvester.—G. W. N. Yost, Corry, Pa.
88,534.—Tire Shrinker.—Joseph Adkins, Warrenton, Ga.

REISSUES.

79,730.—Dated July 7, 1868; reissue 3,342.—Steam Fire Engine.—E. R. Cole and H. S. Cole, Pawtucket, R. I.
51,387.—Dated Dec. 5, 1865; reissue 3,343.—Hand Pegging Machine.—R. W. Drew, Lowell, Mass., assignee of Louis Goddu.
59,957.—Dated Nov. 27, 1866; reissue 3,344.—Machine for Applying Reinforcing Patches to Button Holes of Collars.—G. W. Ray and V. N. Taylor, Springfield, Mass., assignees, by mesne assignments, of J. T. Bruen and G. M. Jacobs.
38,190.—Dated April 14, 1863; reissue 3,345.—Machine for Making Covered Cord.—John Turner, Norwich, Conn., for himself, and assignee of I. E. Palmer.
85,149.—Dated Dec. 22, 1868; reissue 3,346.—Tube for Steam Generators.—G. E. Van Amringe, New York city.
83,345.—Dated Oct. 20, 1868; reissue 3,347.—Binding Books.—F. B. Wells, for himself, and J. H. Cook (assignee of one half of said invention), Fishkill on the Hudson, N. Y.
51,680.—Dated Dec. 26, 1865; reissue 3,348.—Cultivator.—James Armstrong, Jr., Elmira, Ill.
41,411.—Dated Jan. 26, 1864; reissue 3,349.—Harvester.—C. Aultman, Canton, Ohio, assignee, by mesne assignments, of Henry Fisher.
52,968.—Dated March 6, 1866; reissue 3,350.—Wrench.—A. G. Coes, Worcester, Mass.
22,549.—Dated Jan. 11, 1859; reissue 3,351.—Soda-water Apparatus.—Thos. Daniels, Toledo, Ohio.
48,614.—Dated July 4, 1865; reissue 3,352.—Boot and Shoe—A. B. Ely, Newton, Mass., assignee of Francis D. Ballou.
44,637.—Dated Oct. 11, 1864; reissue 3,353.—Nail-cutting Machine.—J. B. Kingham, Dorchester, Mass.
22,812.—Dated Feb. 1, 1859; reissue 3,354.—Machine for Rolling Horseshoe Iron.—W. W. Lewis, Cincinnati, Ohio.
12,780.—Dated May 1, 1855; reissue 3,355.—Shuttle for Looms.—L. Litchfield, F. C. Litchfield, and L. M. Litchfield, Southbridge, Mass., assignees of Lydia W. Litchfield, administratrix of the estate of Laroy Litchfield.
65,003.—Dated May 21, 1867; reissue 3,356.—Reciprocating Steam Engine.—H. O. Perry and J. L. Lay, Buffalo, N. Y.

DESIGNS.

3,431.—Trade Mark.—J. H. Ackerman, New York city.
3,432.—Center Piece.—Henry Berger, New York city.
3,433.—Trade Mark.—S. W. Dexter and D. S. Dexter, Pawtucket, R. I.
3,434.—Oil Cup for Journal Boxes.—Isidore Dreyfus, New York city.
3,435.—Trade Mark.—J. A. Hamlin and L. B. Hamlin, Elgin, Ill.
3,436.—Lamp Chimney.—Robert Hemingray, Cincinnati, Ohio.
3,437.—Front of a Clock Case.—Elias Ingraham, Bristol, Conn.
3,438.—Bird House.—John Murdock, Jersey City, N. J., assignor to John Savery's Sons, New York city.
3,439.—Table Caster Stand.—Wm. Parkin (assignor to Reed & Barton), Taunton, Mass.
3,440.—Fruit Tazza.—Wm. Parkin (assignor to Reed & Barton), Taunton, Mass.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

570.—Mechanism for Making Circular Tenons and Mortises.—W. A. Ives, New Haven, Conn. Feb. 24, 1869.

577.—Harvesting Machine.—Cyrus Newhall, Hinsdale, N. H. Feb 24, 1869.

586.—Furnaces and Apparatus for Oxidizing and Desulphurizing Iron and other Ores.—W. H. Reinoehl, Pine Grove, Penn. Feb. 25, 1869.

625.—Lawn Mowing Machine.—Samuel Colt, Hartford, Conn. March 1, 1869.

629.—Improvement in Navigable Vessels.—John Howe, Jr., Boston, Mass. March 2, 1869.

595.—Ships and other Vessels for Carrying Liquid Cargoes.—W. C Hibbard, West Roxbury Mass. Feb. 26, 1869.

612.—Means for Effecting the Mixture of Molten Cast Iron with Solid Oxides and other Bodies.—T. S. Blair, Pittsburgh, Pa. Feb. 27, 1869.

631.—Water Closets.—John Keane, New York city, and G. H. Brown, Washington Hollow, N. Y. March 4, 1869.

656.—Process for Casting Chain.—C. C. E. Van Alstine and J. C. Hofer, New Haven, Conn. March 3, 1869.

701.—Apparatus for Converting a Reciprocating Motion into a Rotary Motion.—C. L. Spencer, Providence, R. I. March 9, 1869.

709.—Operating Tilt Hammers.—T. T. Prosser, Chicago, Ill. March 9, 1869.

718.—Turbine Wheels.—William Foos and J. W. Bookwalter, Springfield, Ohio. March 9, 1869.

720.—Devices for Rendering Gas Burners Self-Lighting.—Samuel Gardner, Jr., New York city. March 10, 1869.

730.—Cases for Holding Cigars, etc.—H. B. Wheatcroft, S. B. Guernsey, and F. J. Terrell, New York city. March 11, 1869.

739.—Spinning Machinery Materials.—Thomas Mayor, Providence, R. I. March 11, 1869.

Facts for the Ladies.

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Mrs. M. L. Peck.

Mexico, N. Y.

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

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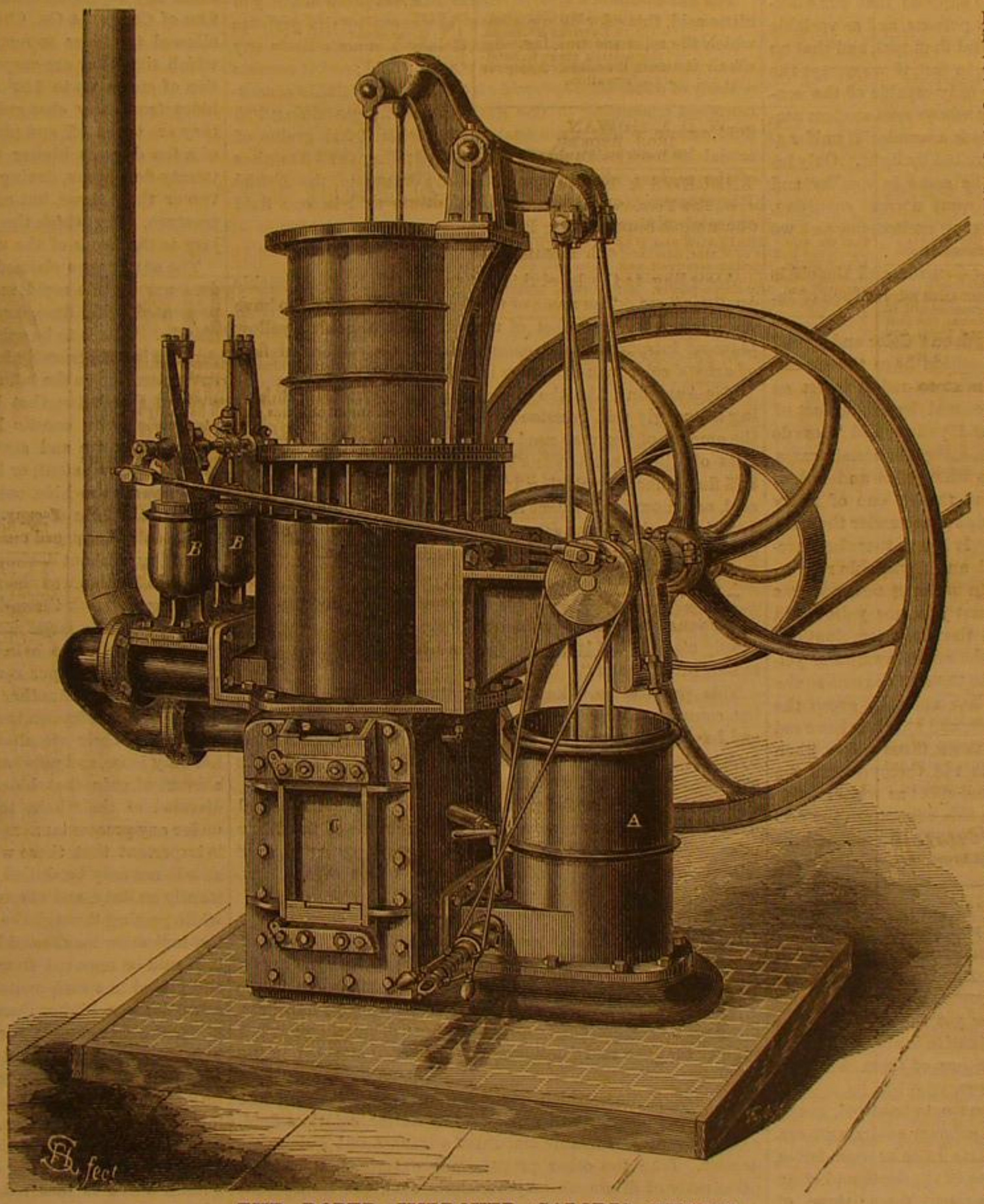
Improvement in Hot-air Engines.

The attempt to substitute air for steam, as a motive power, is not so recent as is generally supposed, patents having been granted in this country as far back as 1824, for atmospheric engines. It appears to have been first used, in a really efficient form, by Rev. Dr. Stirling, of Scotland. He patented an air engine in 1816, and made one which was used for pumping, in 1818, that worked well for a short time. In 1827 Messrs. Parkson & Crosley, of City Road, London, England, constructed an air engine. In 1833 Lieut. John Ericsson, then residing in London, reduced to practice his long-cherished project of a caloric engine, and submitted the result to the scientific world. The invention excited very general attention, and lectures in explanation and illustration of its principles were delivered by Dr. Lardner, Prof. Faraday, Dr. Andrew Ure, and others. In 1837 Sir George Cayley constructed an air engine. In 1851 Ericsson patented his invention in this country, and in 1852 he built the ship *Ericsson*, of 2,000 tuns, driven by his machine, the working cylinder of which was 14 feet diameter, with six feet stroke.

Since then the engine has been considerably improved by himself and others, and it is now recognized as a cheap, safe, and efficient generator of power, within certain limits, and is extensively used in this country. The most perfect form of the engine, with which we are acquainted, is that shown in the accompanying engraving, known as the Roper Caloric Engine, which was first illustrated in No. 7, Vol. VIII., SCIENTIFIC AMERICAN, since which time it has been greatly improved, as the accompanying engraving and description indicates. This engine should not be confounded with other air engines that depend upon heated air alone. Mr. Roper claims to have accomplished, in his engine, what others have attempted and failed, and what experienced engineers claim necessary to a successful caloric engine, viz.; forcing the air directly into the fire, and thereby combining the power of expansion with the power and products of combustion. This result is accomplished, in this engine, by the use of an air pump, close, air-tight doors to the furnace, and poppet valves, arranged as follows:



THE ROPER IMPROVED CALORIC ENGINE.

The air, to supply oxygen for the combustion, is pumped in by pump, A, the carbon is burned rapidly and completely, under pressure, and the resulting carbonic acid gas and uncombined hydrogen gas from the air pass from the generator, or fire box, to the piston by use of poppet valves, B, which act the same as steam marine engine valves.

With this arrangement a quiet, steady pressure is continued in the fire-chamber, or air boiler, and the great difficulty experienced in others, of a blast carrying ashes and too great a heat into the cylinder and burning out packings, is fully obviated. The inside of the fire-box, C, is lined with heavy fire-brick throughout, and a wall of non-conducting material, three inches thick, between the brick and outer jacket, prevents injury to the iron and radiation of heat into the room The late important improvements do not, however, touch the principles of construction so much as the mode of application. At first, Mr. Roper placed his air-pump upon the top of the engine, taking the air, by the use of a pipe, through the casing to the fire-box. In this way the air became partially expanded before reaching the fire. In the improved engine he enlarged the air-pump and placed it on the base near the floor, using the coldest air more direct and with much less friction in clearances, by this means obtaining at once nearly double the power by the same size engine. Next he employed two dampers, one admitting all of the air into the fire-chamber, under the fire-grate, and the other over the fire. The first to be used in time of building the fire, and when it was low, and the other after the fire was complete. Thus the engine can be started as soon as the kindling wood begins to burn. The pump and check valves are made of leather—very simple contrivances. The bearings and all parts of the engine are made stronger and more durable than at first.

One of the greatest improvements obtained is a perfect governor or regulator. The old governor, which was connected with the air-pump, could not be changed so as to vary the speed materially, and did not hold the engine steady when work was thrown on or off suddenly. The present regulator is not much more or less than a safety valve, placed back of the check, taking air from the pressure, in the generator; and by use of a simple thumb screw, the engine can be made to run with the same power from 40 to 120 revolutions per minute, as required, and that with a steady, smooth, unvarying motion, and nearly as noiseless as steam.

We have examined several of these engines, driving different machinery very successfully, of one, two, and four-horse power; and, by inquiry, we find the amount of coal used is about 40 lbs. per day for a horse power, and that the engines fully show the amount of power claimed.

A one-horse power machine weighs about 2,000 lbs., a two-horse power 3,000, and a four-horse power about 5,000 lbs., so that they are readily moved. No water is required in these engines, there is no boiler to explode, and no extra rates demanded for insurance. A boy can manage one as well as an experienced engineer. The engine is the subject of a number of patents.

All orders or applications for information should be addressed to the Roper Caloric Engine Co., 49 Cortland st., New York city, where the machines may be seen.

WHAT is one man's salvation is another one's bane; this old saying is an axiom. Those who urge their remedies or medicaments on others do not understand that in unanimity or oneness there may be diversity.

CONTRAST AND ADMIXTURE OF COLORS.

From a paper on the science of color, by W. Benson, an abstract of which appears in the *Building News*, we collate the following statements relative to the effect produced by the juxtaposition of colors, which are of great value to all engaged in decorative arts. These statements are based upon deductions from the study of prismatic colors, and are confirmed by all sorts of experiments made with the colors of pigments. We may test the colors of pigments with the prism in a beautifully simple way. We have merely to cover a small part of a strip of white paper with the pigment, and view it over a dark cavity, through the prism, and we see the spectrum of the pigment color adjoining to that of the white, and detect at once the rays which are absorbed or extinguished by the pigment, and those which it sends to the eye, to which its color is due. Thus, with respect to yellow, which many will still maintain to be a primary color, unconvinced by the experiments on the combination of the prismatic rays (which show that the best yellow is produced by throwing together all from the first red to the last green ray); if we analyze the color of aureolin, of chrome yellow, or of king's yellow, or the petal of any bright yellow flower, we uniformly find that, the better and clearer the yellow, the more perfectly the object reflects all the red and all the green rays, absorbing only the blue.

Hence, if blue is a primary color, it is difficult to see how it can be supposed that a color produced by all the other rays of the spectrum, is not made up of both the other primaries combined, whatever those primaries are.

Colors intermediate between two pigments cannot be obtained by their admixture. Gamboge and Prussian blue, for instance, make, by admixture or superposition, a green, darker than either the yellow or the blue of those pigments; the scientific method gives, as their intermediate color, a gray of mean brightness, in agreement with the results obtained by experiments on the combination of the prismatic rays. So, also, it does the colors of king's yellow and cobalt, or lemon yellow and French blue or ultramarine.

Mr. Benson claims that facts determined by his experiments on the combination of prismatic rays, as well as those upon pigments, confirm the opinion that red, green, and blue are the primary, and sea-green, pink, and yellow the secondary colors.

In perfect agreement with these facts, are all those apparent changes of color which are perceived when the retina, having been strongly excited by some one or other color, becomes less sensible to it than usual, and every object to which we direct the eye appears, therefore, more or less tinged with the complementary color, as if a wash had been laid over it. For it is always found that in an eye excited by red, by green, or by blue, objects appear tinged with sea-green, with pink, or with yellow, and the reverse; and that by intermediate colors intermediate effects are produced.

Some of these effects have been otherwise described by several writers; it is usual, for instance, to hear it said that red tinges the adjoining colors with green; but this is not correct, unless the one be a pink-red, or crimson, and the other a sea-green green. So again, it is usual to say, that blue and orange mutually deepen each other; but, for this to be true, the blue must be of a sea-green blue or azure hue, and the orange must be yellowish.

The most careful experiments, made by looking steadfastly at spots colored with those pigments which best represent the principal compounds of the prismatic colors, and brilliantly illuminated upon a black ground, and then suddenly directing the eye to a perfectly neutral gray ground, will always clearly show the gray surface darkened and modified in hue in accordance with what I have already pointed out as the real or natural complementaries. Thus, an eye affected with bright red or scarlet, like that of vermilion, turns the gray into a grayish sea-green of the hue of verdigris; one affected with green, like that of emerald green, turns it a grayish pink, of about the hue of rose madder; one affected with blue, like that of cobalt, turns it into a grayish yellow, of the hue of king's yellow, and the reverse. The same effects are seen in the shadows cast by a sunbeam which has passed through strongly-colored glass, upon a gray surface otherwise illuminated by a neutral light; and in many other ways, if due precautions are used. And no doubt the peculiar improvement in depth, which is evident in truly complementary colors when viewed in juxtaposition, the eye glancing rapidly from one to the other of them, arises from the same cause. It is evident, therefore, that the eye itself is so constituted as to agree, in this respect, with the deductions of science concerning the actual relations of colors.

The attempt to reconcile these obvious ocular effects with the common doctrine as to what colors are complementary to each other has led some to regard the deep prismatic blue, which Newton called indigo, as being violet in hue, and the deep prismatic red as being an orange red.

The terms used to distinguish colors are among the most indefinite in all languages; and the loose way in which they are applied, and the different meanings attached to them by different authors, would lead one to suppose that our color-sensations are so different in different persons, and so variable in the same, that they are more fanciful than real, and that no certainty is attainable in them. Yet, in fact, if we except the comparatively few persons who are only capable of the sensations of yellow and blue, and those whose eyes are less sensible than they should be to red, there is a wonderful uniformity and certainty in the sensations excited by light. Only let the rays which enter the eye be the same in quality and quantity, and let the eye be in the same normal condition, without any present or very recent strong excitement, and we may rely upon the results being the same.

But the difference between the new doctrine and the old is more than a difference of terms, for the utmost latitude of interpretation cannot reconcile them.

Sir J. G. Wilkinson asserts in his work on "Color and Taste" that though red and blue in juxta-position have the appearance of purple, and yellow placed next to red gives it an orange hue, the same illusion is not caused by the contact of the other two primary colors, blue and yellow, and these do not look green when in juxtaposition, except in certain cases. Nor is the change then so marked as when blue and red, or yellow and red, are in contact. And this is one of many proofs that all the three primary colors are not under the same conditions, in relation to each other. It is not, therefore, necessary to lay down the same general and invariable rule respecting the three primaries, that "in making new patterns or ornaments, red and blue should not join, nor yellow and red, nor yellow and blue," as though the three combinations were exactly similar, and subject to the same laws. For yellow and blue do not deceive the eye to the same extent as the others, when in juxtaposition. Nor has red with green the same effect as red with blue and yellow, and still less have red blue and yellow the same effect as these three colors when united in one,—that is, according to the theory which the author received, they have not the same effect as white.

Such anomalies as those noticed in this extract are the necessary consequences of an erroneous theory. Of course, blue and yellow cannot be treated in the composition by the same rules as blue and red; for blue is complementary to yellow and not to red. Still less can yellow and red be treated by the same rules as yellow and blue; for yellow harmonizes with red, itself containing the full red in conjunction with the full green, while it contrasts as the opposite color to blue. No wonder that red, yellow, and blue together have not the same effect as red and green together, nor yet the same effect as white; for the mean of the first combination is always reddish, and of the second yellowish, and neither of them white or netural, whatever proportions are taken.

We ought, in the opinion of Mr. Benson, to treat red, green, and blue under the same rules as primary colors, and sea-green, pink, and yellow under the same rules as secondaries, if only we bear in mind the differences in the depth and clearness of the pigments we use to represent them; these, of course, modifying the effects in a large degree. Two primaries of similar depth may please the eye when side by side, while the same two, equally true in hue, but not alike in depth, may fail to do so. A great step will assuredly be gained if we establish correctly the hues of the three simple color-sensations, and of their complementaries; for these, together with black and white, will give us the eight principal colors upon which to work, and will enable us to determine all the intermediate colors correctly, and to arrange them all with due regard to their natural gradations and contrast of every kind.

Tolling Great Bells.

A new method of hanging very large bells has been tried at Worcester, England, it would appear with perfect success. The bell upon which the experiment was tried weighed four and one-half tuns. The plan is to make the gudgeons upon which the bell is hung, V-shaped, like the bearings of an ordinary scale beam. These rest on brasses very slightly hollowed. The friction was so greatly reduced by this method, that, according to the *Builder*, this ponderous bell was tolled for afternoon service on Sunday, 17th January, by the Rev. H. T. Ellacombe, that gentleman using only one hand, although a small man and nearly 80 years of age. It is said to be easier than pulling the clapper by a rope, beside being less likely to crack the bell. Another great advantage is that the tone of the bell comes out much more grandly than by clappering. No wheel is required in this mode of bell hanging, the power being applied by a lever fixed to the stock. The gudgeons must not be lower than the top of the bell. The diameter of the mouth of the bell alluded to was seventy-six and one-half inches.

HOW GOLDEN HAIR IS OBTAINED.

Every one who is observing of the peculiarities of fashion, must have noticed the increase of golden hair displayed in such profusion by the belles upon the promenades and elsewhere. It has been a subject much discussed and considerable curiosity has been displayed in regard to the way in which the thing is accomplished. It is quite plain that some artificial means must be employed. Mr. Henry Matthews, F. C. S., has been letting the cat out of the bag; in the London *Chemist and Druggist* he gives the results of some analyses of "Golden Hair Fluids," and for the benefit of our fair readers, as well as the curious of the male sex, we transcribe them.

1. AURICOMUS OR GOLDEN FLUID.

This, to quote from its label and bills, "though harmless as pure water, has the astonishing power of quickly imparting a rich golden flaxen shade to hair of any color. Unlike other preparations, it has neither spirit nor alkali in its composition," etc.

The auricomus is a clear, colorless fluid, smelling slightly of nitric acid, this odor being almost overcome by the perfume which the mixture contains. It certainly does not contain any alkali, inasmuch as its reaction is strongly acid; and it consists entirely of *dilute nitro-hydrochloric acid*, the non-volatile constituents not amounting to one grain in a bottle containing 2·25 fluid ounces, which, upon analysis, furnished 0·955 grains of actual hydrochloric acid (HCl); corresponding to 23·3 minims of the acidum nitro-hydrochloricum dilutum of the *British Pharmacopœia*, or 10·35 minims of dilute acid in one fluid ounce of mixture.

2. ROBARE'S AUREOLINE.

According to the label this is "free from all objectionable qualities," etc. The name of this preparation appears to have been borrowed from that of the well-known golden yellow pigment introduced and manufactured by a celebrated firm of artists' color manufacturers in Rathbone-place.

The Aureoline, like the Auricomus, is a colorless fluid having a strongly acid reaction and an odor of nitric acid, which the amount of perfume used does not conceal, and it also consists of dilute nitro-hydrochloric acid; a bottle containing 3·75 fluid ounces furnishing 1·74 grains of actual hydrochloric acid, an amount equivalent to 42·4 minims of dilute nitro-hydrochloric acid of the *Pharmacopœia*, or 11·3 minims of the dilute acid in one fluid ounce of Aureoline.

3. NICOLL'S GOLDEN TINCTURE.

The label of this article has the merit of not making any professions as to the perfect harmlessness of its ingredients, simply stating that it is "for giving a brilliant golden shade to hair of any color."

This preparation, like the preceding, is a colorless fluid, but containing a very slight deposit, smelling of nitric acid, and having a strongly acid reaction, consisting of dilute nitro-hydrochloric acid, together with a trace of sulphuric acid, the amount of non-volatile constituents being inconsiderable.

A bottle containing 2 fluid ounces gave 0·5 grains of actual hydrochloric acid, corresponding to 12·1 minims of the dilute nitro-hydrochloric acid of the *Pharmacopœia*, or equal to 6 minims of the dilute acid to one fluid ounce of the compound.

4. ROSS'S SOL AURINE.

On the wrapper of this we are told that "The production of a preparation which shall imitate nature in its loveliest aspect with regard to that tint of hair so fashionable in ancient classic ages," etc.,—"and which shall at the same time be harmless, has been a desideratum,"—and the reader or purchaser is left to infer that the said "desideratum" has been attained in the "Sol Aurine."

The Sol Aurine, which has a strongly acid reaction and smells most distinctly of nitric acid, is a clear, colorless fluid, containing a considerable amount of a transparent gelatinous deposit. Like the other preparations examined, it consists principally of dilute nitro-hydrochloric acid, the transparent deposit consisting of precipitated silica. A bottle holding 2·5 fluid ounces furnished 2·77 grains of anhydrous hydrochloric acid, corresponding to 67·2 minims of the acidum nitro-hydrochloricum dilutum, B. P., or equal to 26·8 minims of *Pharmacopœia* acid per fluid ounce of Sol Aurine. Other than the deposite of silicious hydrate before mentioned, the non-volatile constituents were inappreciable in amount, and were, as in the other fluids examined, such as would be evidently due to the use of either common water or impure acids in the preparation of the washes.

In conclusion Mr. Matthews remarks:

"There is little doubt that all of the above preparations would effect the purpose for which they were intended, the principal agent in all of them being the nitric acid, the effect of which is possibly aided by the bleaching power of the very small portion of nascent chlorine derived from the decomposition of the hydrochloric acid by the nitric acid.

"With regard to their use being safe or otherwise I am not prepared to speak positively, but I have been informed by a medical friend, Mr. Charles Matthews, of Southampton-street, Strand, that he has, in the course of his practice, been called upon to attend ladies who, by the incautious use of golden hair fluids, had produced burns from portions of the fluid falling upon their necks and shoulders.

"I am, however, bound to say that I was unable, with any of the preparations mentioned above, to produce even a slight stain upon the skin; but, as of course, I could only experiment upon myself, I cannot say what might be the effect on the whiter and more delicate surface of the necks and shoulders of the fairer sex.

"In conclusion, I would observe that, as far as the preparations examined are concerned, it is satisfactory to find that they contain no compounds of antimony or arsenic."

PRACTICAL SUGGESTIONS ON TANNING LEATHER.

BY C. GILPIN.

(Continued from page 178.)

THE ADVANTAGES OF QUICK-LIMING.

Another subject to which I gave some attention, while paying my respects to the tanners, was that of liming, and observed that a wide difference existed among them in relation to the time occupied in putting the hides through this process, and divesting them of the hair, which is of course the object of liming, primarily considered. Some of the best and most extensive manufacturers are so thoroughly satisfied of the injurious influence of lime upon the gelatin of the hide, that they have abandoned the use of lime altogether. That much of the gelatin can be extinguished by its too free application to the hide there now remains no doubt upon the minds of those who have fully tested it; others claim that by allowing the hides to remain in the lime from six to ten hours, they avoid any injurious influences. The superintendent for the firm of Craigan & Co., Chicago, Ill., informed me that he only allowed the hides to remain in the lime eight hours, during which time they are suspended on reels, kept by the application of steam up to 110° Fahrenheit, and the position of the hides frequently changed by turning the reels, after which they are taken off and placed in a pool containing pure water of a few degrees higher temperature, where they remain for twenty-four hours, during which time the water is changed two or three times, but constantly kept at the necessary temperature, after which the hair is easily removed without injury to the hands of the workman.

The advantages claimed for this method are, that the hide does not by this rapid movement become so thoroughly impregnated with lime, consequently less loss is sustained in gelatin. This is to be accounted for upon the principle, which perhaps is not generally known to those who have given but little attention to the influence of lime upon animal matter in a chemical relation, that by bringing the hide in direct communication with caustic lime and allowing it to remain too long, the texture and strength of the fiber are impaired to a greater or less extent, or in proportion as the lime is allowed to penetrate the hide, entering the pores and remaining in them in the form of caustic, carbonate, or lime soap, and cannot be entirely purged out by any amount of fulling, working, or baiting, without destroying a portion of the gelatin of the hide; and which was dislodged under the primitive method of working the stock through the beam house by low baiting, at the expense of a large portion of the gelatin, and was mainly the reason why the gain was so small in those days when thirty-five to forty per cent was considered all the best hide was capable of. Another evidence of the advantage of low liming, which is known to all practical tanners who have given the subject their attention, is, that all high limed leather is not only loose, and pervious to water, but will not produce the amount of gain that hides will that have been low limed, or divested of their hair, through the sweating process; and under any process tanners should always bear in mind, that it is important that those who have charge of this department should not only be skilled thoroughly in their art but be constantly on duty, and observe closely the condition of the stock while passing through the Beam House; and at the very earliest indication manifested by the hide, of yielding up the hair, it should be removed from the influence of the lime at once, and placed in a soak containing clean water, at a temperature a few degrees higher than the lime liquor they are taken out of, for the reason that it not only prevents the pores of the hide from contracting, but slightly expands them and aids the hide in its effort to give up the hair; this will also avoid setting the hair, which is often the case, when the hide after being taken out of the lime, is thrown into cool water; and by wrenching the hides in the pool through two or three baths of warm water the lime is purged out without the loss of gelatin which is incurred through the wrenching wheel or fulling stocks, while the hide is in this loose and porous condition; at which stage of its progress, great care should be observed that its substance is not wasted; for therein consists in a large degree the profit.

While much has been said upon the subject of gain made by the manufacturer, I took considerable pains to inform myself upon this subject, also the average length of time occupied in tanning out a stock of sole or belting leather, and am satisfied, basing my calculations upon the most reliable data, that the average gain made throughout the entire fraternity, is not over fifty per cent, and the time required to tan out the stock, six months.

Some tanners make sixty and as high as sixty-eight per cent on some stocks, but these are the exceptions, and not the rule. And as further evidence of the influence of time upon the stock, I found that in every instance where the greatest gains were made the hides had either been sweat or very low limed. It is supposed to be generally known that a new lime is more caustic than one that has been made for some time, whether it has been used or not; and will to a considerable extent bind the hair during the first few hours, rather than cause the hide to yield it up. This is caused by the influence of the caustic upon the cuticle of the hide, which, being very delicate, shrinks or contracts to a certain extent when brought directly in contact with the strong alkaline properties of the lime; this can be modified to a great extent, by allowing the lime to remain in the vessel in which it is slacked, for at least twenty-four hours. The water should be placed in the vessel first, and the lime thrown into it, and after the contents are thoroughly slacked it should be frequently plunged or stirred to allow the oxygen generated by the slacking process to escape, or become modified, and thereby changing the caustic properties into what is chemically known as lime soap, the influence of which upon the hides is, to soften it, without distending the fibers so severely, as will fresh slaked lime.

Probably most practical tanners who have given the beam house much attention, have observed one fact, that when a pack of hides is taken from a new lime, they present a stiff, harsh appearance and feel, and the hair does not slip as freely, although longer going through the process, as when put through a lime liquor that has been used for several months, and which turns the hides out in a soft, pliable condition, and as a consequence yields up the hair much more readily. Some tanners only make entirely fresh or new limes, two or three times during the year, because their experience has instructed them, that a hide is more thoroughly and rapidly denuded of hair, through the medium of an old lime, than in a fresh one; because the former is less caustic, and operates more directly upon upon the earthly matter deposited around the roots of the hair, and perhaps this is the reason why acids have been adopted by some, as a substitute for lime, as they are known to act more immediately upon the roots of the hair which are impregnated and surrounded with a material that partakes largely of carbon, which is to a greater or less extent imparted to the hair, and renders it almost invulnerable to decomposition. This element has a strong affinity for acetic acid, and is readily disolved by being brought in contact with it. Submitting these facts for consideration of the trade, we will pass on to give our view upon other matters no less important to the leather interest.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. IV.

The most powerful opponents with which gunpowder apparently has to contend, are nitro-glycerin and gun-cotton, and this on account of the extraordinary amount of power they possess; indeed, under certain conditions, they develop an almost irresistible force. But it is just this attribute of resistless violence, which has hitherto rendered them the most unsafe, the most dangerous compounds that can be applied to practical purposes. Man loses all control over these agents, inasmuch as an accidental blow or a slight concussion may—nay, must—produce a violent and perhaps most disastrous explosion. It is of no avail to possess a material which does several times the work of any other adapted for the same purpose, if life and property are in momentary danger of destruction. That this was one of the perilous conditions under which nitro-glycerin and gun-cotton were employed, is evidenced by numerous accidents which have occurred within the last few years in connection with their application to blasting purposes. But, both these dangerous agents have, within the last twelve months, been brought under control, and their action has been so modified that they may now be said to possess all the conditions necessary to constitute a safe and highly efficient material for blasting purposes.

Taking them in the order to which they are referred to above, let us first examine the merits and demerits of nitro-glycerin which is one of the most remarkable materials employed to replace gunpowder as a destructive agent. This substance was discovered by Sobrero, in 1847, and is produced by adding glycerin, in successive small quantities, to a mixture of one volume of nitric acid of sp. gr. 1·43, and two volumes of sulphuric acid of sp. gr. 1·83. The acid is cooled artificially during the addition of glycerin, and the mixture is afterward poured into water, when an amber-colored oily fluid separates, which is insoluble in water, and possesses no odor, but has a sweet, pungent flavor, and is very poisonous, a minute quantity placed upon the tongue producing violent headache, which lasts for several hours. The liquid has a specific gravity of 1·6. and solidifies at about 5° Cent. (40° Fah.); if flame is applied, nitro-glycerin simply burns; and if placed upon paper or metal, and held over a source of heat, it explodes feebly after a short time, burning with a smoky flame. If paper, moistened with it, be sharply struck, a somewhat violent detonation is produced.

In 1864, Mr. Alfred Nobel, a Swedish engineer, first attempted the application of nitro-glycerin as an explosive agent. Some experiments were, in the first instance, made with gunpowder, the grains of which had been saturated with nitro-glycerin. This powder burnt much as usual, but with a brighter flame, in open air. When confined in shells or blast-holes, greater effects were, however, produced with it than with ordinary gunpowder; its destructive action is described as having been from three to six times greater than that of powder. The liquid could not be employed as a blasting agent in the ordinary manner, as the application of flame to it from a common fuse would not cause it to explode. But Mr. Nobel has succeeded, by employing a special description of fuse, in applying the liquid alone as a very powerful destructive agent. The charge of nitro-glycerin having been introduced, in a suitable case, into the blast-hole, a fuse, to the extremity of which is attached a small charge of gunpowder, is fixed immediately over the liquid. The concussion produced by the exploding powder, upon ignition of the fuse, effects the explosion of the nitro-glycerin. The destructive action of this material is estimated to be about ten times that of an equal weight of gunpowder, so that if we take 32,000lbs. as the average of work done by 1lb. of gunpowder, as stated in the early part of this paper, we get 328,320lbs., or about 146¼ tuns, as the work done by 1lb. of nitro-glycerin. Therefore, although its cost is about seven times that of blasting powder, its use is attended with great economy, more especially in hard rocks, a considerable saving being effected by its means in the labor of the miners, and in the time occupied in performing a given amount of work, as much fewer and smaller blast-holes are required than when gunpowder is employed. The material appears to have received considerable application in some parts of Germany and in Sweden; but, in England, it has not progressed beyond the stage of experimental trials.

Although nitro-glycerin appears to possess very important advantages over gunpowder as a blasting and destructive agent, the attempts to introduce it as a substitute for gunpowder, have been attended by most disastrous results, ascribable in part to some of its properties, and the evident instability of the commercial product. The explosion which occurred on board the West Indian Company's steamer *European*, will long be remembered by many. This distressing event happened on April 3, 1866, when the *European* was unloading her cargo alongside the railway company's wharf at Aspinwall. The force of the explosion was such as to tear away the upper parts of the ship, and to blow the plates off her sides. The wharf, too, which was some 400ft. in length, was literally torn to pieces, and about fifty persons killed, while many others were seriously injured. By the ship's bill of lading a number of cases of nitro-glycerin were proved to have been on board, and doubtless careless handling of these packages, by men who were ignorant of the dangerous nature of their contents, led to the catastrophe. As if to impress the public still more strongly with the peril attending even the mere transport of this destructive agent, another accident occurred on the 16th of the same month. Two oil-stained boxes, each measuring about 4 cubic feet, arrived at San Francisco by the Pacific mail steamer. They were removed from the ship into the city, in which they had no sooner been deposited than they exploded with a violence that shook the neighborhood like an earthquake, for a quarter of a mile around, and proved terribly fatal to human life. It was publicly stated that the boxes contained nitro-glycerin which was intended for sale to the mining companies in Nevada, Idaho, and Colorado. In Sydney, New South Wales, too, a tremendous explosion occurred on March 4, 1866, in the stores of Messrs. Molison & Black, in Bridge street, which were totally destroyed. The noise of the explosion is said to have very much resembled the discharge of artillery, while a column of the *debris* was thrown to a hight of about 150ft. A great amount of damage was done to the surrounding buildings, and property to a serious extent was destroyed. This explosion was traced to two packages of nitro-glycerin.

There is yet another danger attending the substitution of nitro-glycerin for gunpowder in mining, and this relates to its manipulation when being prepared for firing a shot. Although the oil may have been safely transported to its destination, there is no guarantee that its destructive energy will not be developed before it is placed in the hole which is intended for it. Indeed, there are instances on record which show how slight a circumstance serves to spread death and destruction around, even in the handling of this material. It should be observed that among other disadvantages, nitro-glycerin freezes at a somewhat high temperature, in which condition mere friction will explode it. A sad illustration of this fact occurred in 1867 at Hirschberg, in Silesia, where nitro-glycerin was being used in the boring of a railway tunnel. The oil was one day found to be frozen, and in this state was delicately handled, and fragments were detached by means of a piece of wood. In the bore holes the frozen nitro-glycerin exploded quite as well as the fluid. One day an overseer attempted to break up a lump of the frozen material with a pick. The result was a violent explosion of the whole mass, which caused the death of the incautious miner. Several accidents have also occurred in our own country since the introduction of nitro-glycerin, and many of those who were the first to experiment with it, have already given up its use. This material, therefore, was only worthy of utter condemnation for its fearfully dangerous and uncertain character, even under the most favorable circumstances. Its resistless energy is fully admitted, and its great value in this respect for mining operations duly recognized; but, inasmuch as it does not appear that there are any conditions under which it can be handled with safety, its use ought certainly to be everywhere prohibited.

AMBERGRIS.

This singular substance is one among those derived from animal sources that are employed in the perfumer's art, and although its origin would seem to preclude its use by the fastidious, the same objection would equally apply to musk, the product of the civet cat or musk deer, which if not an excretion is a secretion intended probably, as is the offensive liquid ejected by the skunk, as a means of defense. Ambergris, or "gray amber" as its name denotes, is simply and only a portion of the excreta of the sperm whale, *Physeter macrocephalus*, resulting from disease. It is considered generally to be a result of a morbid secretion of the whale's liver, and is probably produced also by other oceanic mammalia. It is usually found floating on the surface of the sea in those parts of the ocean most frequented by the spermaceti whale; a small barren island off the coast of Yucatan, having received its name of Ambergris from the quantity of that substance found on its shores.

Whale fishers look for it in the intestines of the whale, and its value is so great that whalemen pursue with eagerness the sickly cetaceæ although they promise a scant return of oil. It is amorphous, or in roundish pieces, frequently formed in layers, of a grayish color—whence its name—with streaks of whitish yellow, brown, or black. It has a waxy texture and when warmed emits a pungent odor. It is for this quality it is so highly esteemed. It has been sold for its weight in gold. It is very scarce and seldom appears except as "essence of amber" or "extrait d'ambre," forms of perfumery having this material for their base and bearing a very high price.

Its discovery is not at all new. It is pretty certain it was known as a rare perfume in the fifteenth century, for Sinbad, the sailor, being wrecked somewhere in the Indian Ocean says:

"Here is also a fountain of pitch and bitumen that runs into the sea, which the fishes swallow, and then vomit up again, turned into ambergris."

Piesse in his "Art of Perfumery" does not rank the perfuming value of this substance highly; for he says: "A modern compiler, speaking of ambergris, says 'it smells like dried cow dung.' Never having smelled this substance we cannot say whether the simile be correct; but we certainly consider that its perfume is most incredibly overrated; nor can we forget that Homberg found that a vessel, in which he had made a long digestion of the human fæces, had acquired a very strong and perfect smell of ambergris, insomuch that anyone would have thought that a great quantity of essence of ambergris had been made in it. The odor was so strong that the vessel was obliged to be moved out of the laboratory."

We cannot agree with Homberg, for when first, some twenty years ago (and recollections of scents are among the most tenacious), we tested some fragments just brought in by a whaling ship, we very much admired the aroma, but—we are also partial to musk.

It is generally found in small quantities of only a few pounds or perhaps ounces in weight, but large masses have been discovered, one weighing 174 lbs. having been purchased in the East Indies by the Dutch, and a mass of 237 lbs. being obtained by the French East India Company. Lately, however we read that Captain Timothy C. Spaulding, of the bark *Elizabeth* of New Bedford, while coming southwest of Madagascar, struck a very large sperm whale. On opening the whale they had the good luck to discover 285 pounds of ambergris—worth on the spot $20,000.

Another New Bedford whale ship, the *Herald*, lately brought home 71 lbs. of this substance that sold for $97 per lb.

Floor Coverings.

A covering for floors is now made in England, by gluing together a number of pieces of wood of different colors, and from this block thin veneers or slices are cut, which are then fixed by cement or glue to a woven cloth, or any other such material as may be preferred. Each veneer will have on it a pattern resulting from the arrangement of the pieces in the block from which it is cut, and by assembling a number of them together a complicated pattern is obtained; or when it is desired to have a simple pattern, the slices or veneers may each be cut from a single block; and it may be formed by arranging these pieces together. Various kinds of wood can be employed in this arrangement. A floor-cloth or covering thus prepared may be glued down to the floor which it is wished to cover, or, for temporary purposes, may be secured by nails. Also, this invention includes the use of veneer patterns nailed to any ordinary floor; such veneers of hard wood are reduced in thickness at their edges or corners, and are nailed to the floor beneath, the nails being covered by thin pieces of veneer, thinner than the others, and cut to a desired form, so that the whole makes an ornamental pattern. These pieces are, moreover, glued into their places, and the whole forms a flush and smooth surface.

Copying Copper-plate Engravings on Stone.

Lieutenant Hall of the Coast Survey states that copperplate engravings may be copied on stone; specimens are to appear in the forthcoming report. To quote his description: "A copperplate being duly engraved, it is inked, and an impression taken on transfer-paper. A good paper, which wetting does not expand, is needed, and a fatty coating is used in the process. The transfer-paper impression is laid on the smooth stone, and run through a press. It is then wetted, heated, and stripped off from the stone, leaving the ink and fat on its face. The heated fat is softly brushed away, leaving only the ink-lines. From this reversed impression on the stone, the printing is performed just as in ordinary lithography. A good transfer produces from 3,000 to 5,000 copies. Thus prints from a single copperplate can be infinitely multiplied, the printing being, moreover, much cheaper than copperplates.

Laminated Wooden Pipes.

We have lately examined at Mr. C. Lenzmann's office, No. 18 Dey street, New York, some specimens of Mayo's patent wooden pipes, having interior diameters of six inches and two feet. These pipes are composed of veneers, or thin sheets of wood, wound upon each other, cemented with bitumen, and lined with hydraulic cement. The samples we examined were about an inch in thickness, and, we were informed, had been tested by hydraulic pressure up to 310 lbs. per square inch without sign of fracture.

The improvement appears to be one of much value. The method of laying up the sheets in bitumen is calculated to render the material imperishable; and as the tubes can be made of any size, and furnished at much less rates than metal pipes, we see no reason why the invention should not come into extensive use for aqueducts, sewers, and other purposes.

Messrs. Walsh & Watkins, have laid a 11-inch plate iron water-pipe, from a point on a mountain side in Tuolumne county, California, down the mountain, under a creek and up the ascent on the other side, in all 8,800 feet in length, and under a perpendicular pressure at the lowest point of 684 feet.

INTERNATIONAL TRIAL OF REAPING MACHINES.

An international trial of reaping machines, under the auspices of the Royal Hungarian Board of Agriculture and Trade, is projected by the Agricultural Society of the County of Wieselburg at Ungarisch-Altenburg, from the 5th to the 10th of July, 1869. The following rules have been adopted:

I. No other machines but reapers are admitted for trial and competition.

II. Reapers generally require a greater draft than that of two Hungarian horses, and for this very reason these machines have not, up to the present time, been in such general use as could have been wished; therefore, such competing machines will be preferred which do not require a greater draft than that of two middle-sized horses, their effect being of course in proportion.

III. The utmost simplicity consistent with durability in the construction of the machine is one of the first conditions for an award of a premium.

IV. Apart from all other qualities, a machine with self-delivery will be preferred, or a combined one to be also used for mowing grass. This said qualification is not, however, absolutely necessary in machines requiring but light draft.

V. All other qualifications being equal, preference will be given to those machines which will cut tangled or lodged grain, require least manual labor, scatter least corn, waste least straw, are the easiest to move, are lowest in price, and which deliver the straw in the most regular manner to admit of the sheaves being bound in the readiest way.

VI. Experience has proved that the Hungarian oxen, from endurance, strength, and swiftness, are well adapted for working reapers, the Agricultural Society therefore think it desirable that the speed of the knives of such machines which require more than 250 German pounds, should be modified to suit the pace of the native horses and oxen. The poles must also be arranged for oxen.

VIII. Premiums will be offered as follows:

First, for reapers constructed with self-delivery: 1st prize, 60 ducats and a gold medal. 2d prize, 40 ducats and a gold medal. 3d prize, a large silver medal.

Second, for reapers not constructed with self-delivery: 1st prize, 50 ducats and a gold medal. 2d prize, 30 ducats and a gold medal. 3d prize, a large silver medal.

VIII. The jury, which consists of Professors of the Royal Agricultural Academy, of Ungarisch-Altenburg, by approved deputies of the agricultural societies of Pest and Vienna, and representatives of agricultural societies of various countries, will pronounce its judgment on the reapers in a competent and strictly impartial manner.

IX. All other points not specially mentioned here, with regard to awarding the prizes, and the system of proceeding to be observed, will be arranged by the above jury.

X. Every competing reaper must cut no less than one Austrian acre (equal to about 7,000 square yards). Each competitor will have a suitable space allotted to him to experiment on previous to the trial. Horses or oxen for all trials are furnished by the Committee.

XI. No competing machine is allowed to withdraw before finishing the trial without the consent of the jury.

XII. The Agricultural Society, in inviting all native and foreign manufacturers of agricultural implements to send reapers, announce that the proper authorities will be requested to grant a reduction of freight and toll duties, the result of which request will be published as soon a possible.

The competing reapers are to be sent "Zur Ernte-maschinen-Concurrenz, in Ungarisch-Altenburg, letzte Eisenbahnstation Wieselburg, an der Wien-Neuszonyer Linie, Ungarn."

XIII. Manufacturers wishing to send reapers for this exhibition are requested to give notice before the 30th of June, to "Herrn R. Rath Paul Major, Vice-Präsident des landwirthschaftlichen Vereins Ungarisch-Altenburg," giving the number of reapers to be sent, stating whether self or hand delivery, the prices at factory, and if possible, the prices delivered both at Vienna and Pest, and further, whether a man will be sent to work the reapers or whether the society are to provide one.

The 30th of June is the latest day for the arrival of reapers at Ungarisch-Altenburg.

N. B.—The Committee will see that all due care is taken of the machines on arrival.

XIV. The Agricultural Society will also publish a precise report of the trial of the reapers, so that the result may be known both in Hungary and in foreign countries.

The Secretary of the above society is Charles Kopfmann, who may, we presume, be addressed by parties interested.

Smoky Chimneys.

The *Architect*, a London weekly, gives, the following summary of the causes of smoky chimneys, condensed from a new work on the subject, published by Longmans, which seems certainly very comprehensive as well as concise.

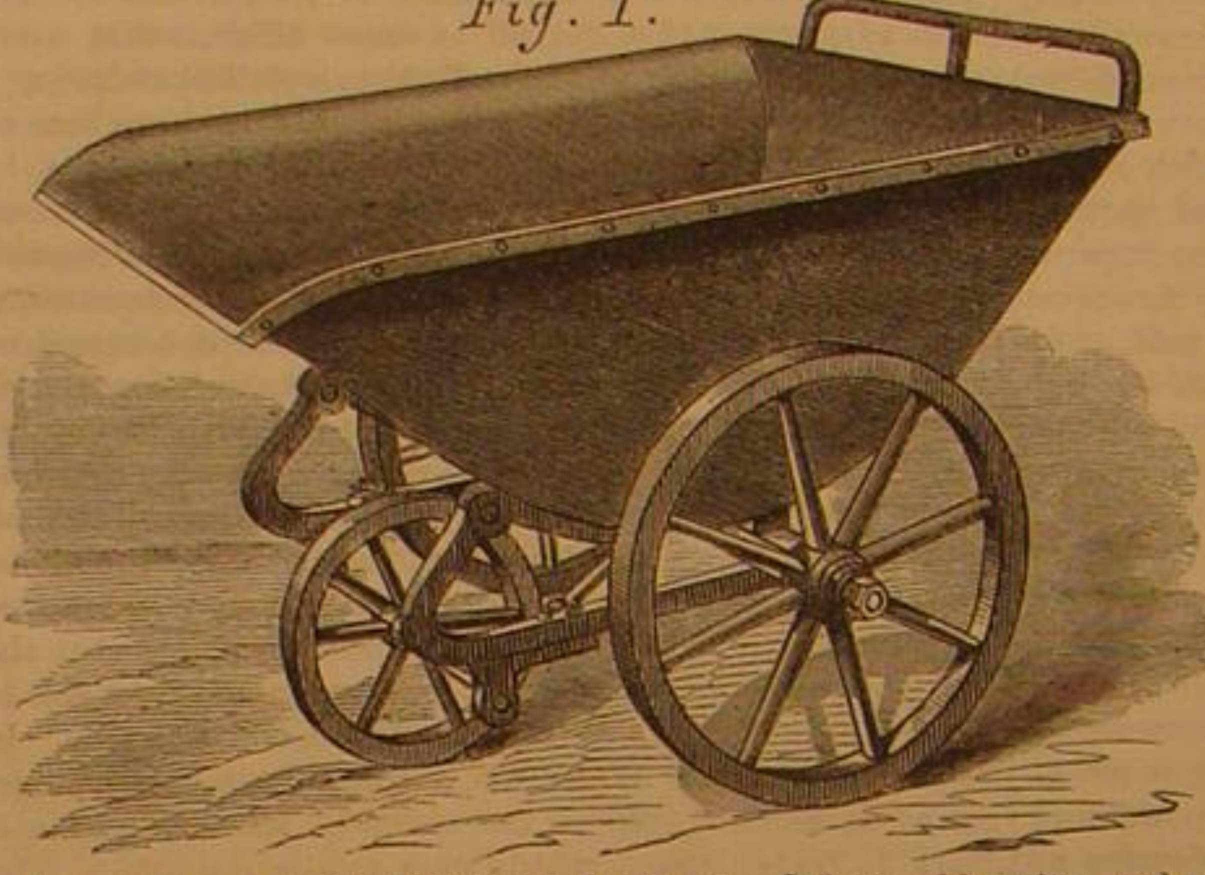
"Want of sufficient hight in the flue. The outlet of the chimney being placed in an exposed and cold situation, while the air with which the fire is supplied is drawn from a warmer and more sheltered region. Excessive width in the flue, by which a large volume of cold air is drawn in and allowed to lower the temperature of the ascending column. Low temperature of the interior of the flue in comparison with that of the external air. Humidity of the air. Too accurate fitting of the windows and doors, and joints of the flooring. The draft of one fire injuring that of others in the same house. A current caused by the heat of the fire circulating in the room. A flue of insufficient size. A foul flue. Displacement of masonry, or accumulation of mortar within the flue. The sudden obstruction of the draft by gusts of wind entering the chimney top. Increase of density of the air at the chimney top, due to the effect of wind in chimneys rising from the eaves of roofs. Drafts within the room which throw the smoke out of the influence of the ascending chimney current.

"Of course the remedies consist in the removal of these causes, but the suggestion given that the kitchen flue should be at the north or east end of a stack is sagacious; also, the recommendation to supply fire with air for its own consumption, drawn from the coldest side of the house. The arrangement proposed with this aim is ingenious, and no doubt capable of easy and effective application in a large proportion of cases; but the question of the exact position, size, and adjustment of the air inlet near the hearth appears to us yet open to further investigation; and it must not be forgotten that any such arrangement dimishes the efficiency of the open fire as a ventilator of the room."

FARMER'S HAND DUMPING BARROW.

The object of the device, of which the accompanying engravings are representations, is to furnish a hand barrow, superior to those generally in use, for mines, coal yards, rail-

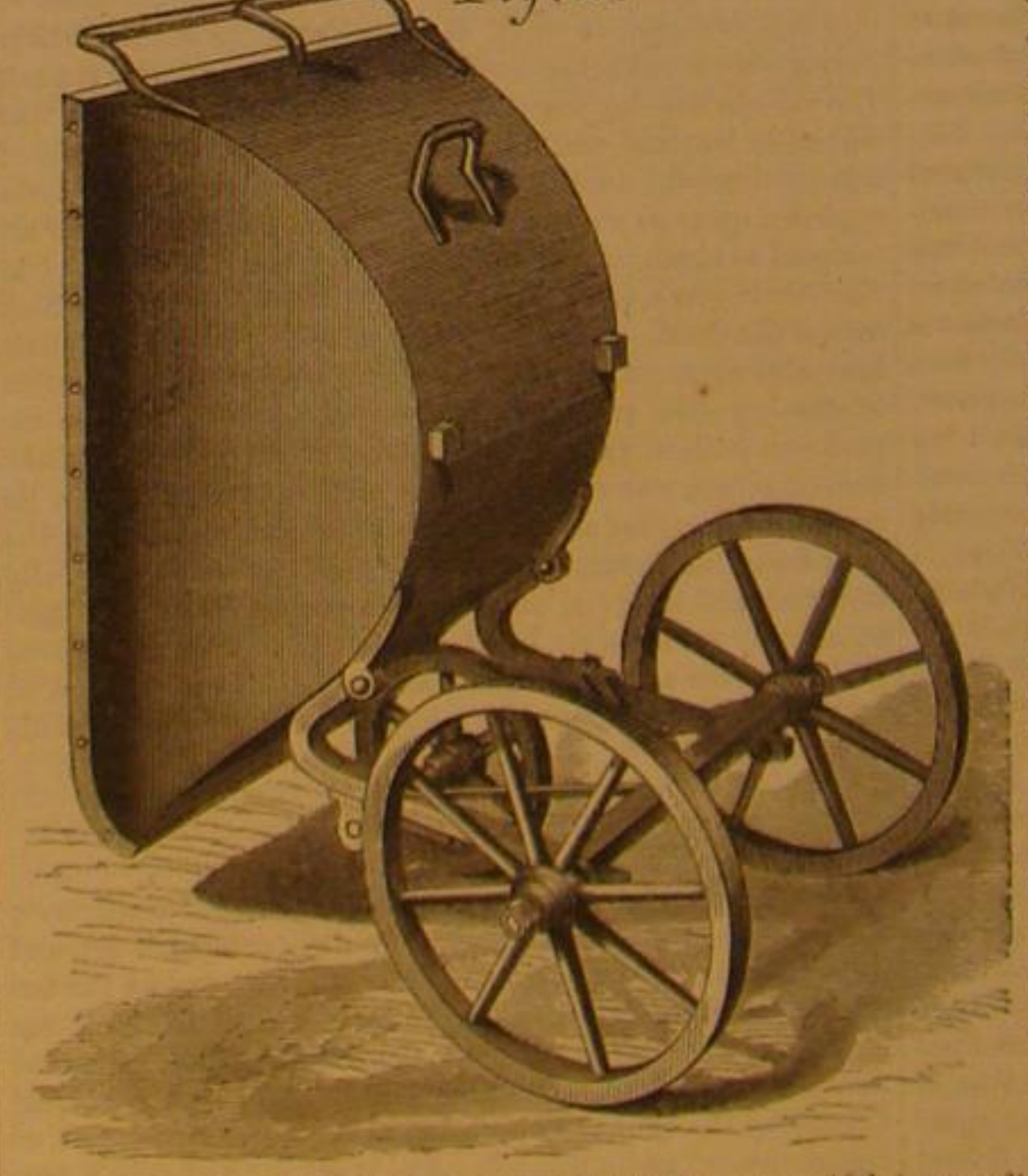
Fig. 1.



road stations, gas works, founderies, farms, etc. It is capable of turning very short corners, under perfect control, readily handled by one man, cannot be overturned by accident, and dumps its load easily. It has an additional advantage over the ordinary barrow in being shorter by the diameter of the wheel and the length of the barrow handles.

Fig. 1 is the cart in position for receiving its load; Fig. 2 is the cart reversed for delivery. When loaded the weight is borne almost wholly by the axle which carries the two large wheels. The pivots on which the cart body turns in the act of dumping are directly over the small leading wheel which then receives the weight. The load may be so adjusted that but a slight effort will be required to tilt it either way, to raise the front wheel in turning short corners—done by bearing down on the handle at the rear—or to deliver the load by lifting lightly on the handle. These barrows may be seen in

Fig. 2.



use at the works of the Manhattan Gas Light Company, 18th street station, North River, and 14th street station, East River, New York city.

Patented through the Scientific American Patent Agency, March 16, 1869, by Wm. Farmer. For State and county rights, or further information, address Herring & Floyd, 740 Greenwich street, New York, or the patentee at the Manhattan Gas Works, 18th street, North River station, New York city.

Sea Tunnels.

Under-sea tunnels are attracting the attention of English engineers. In addition to the projected tunnel under the English Channel, between Dover and Calais, it is now proposed to unite Scotland and Ireland by a tunnel, running from a point on the north-east coast of Antrim, Ireland, to Glenstrone, Scotland, passing through the high rocky peninsula called the Mull of Cantyre. The total length of the tunnel is estimated at fourteen miles three furlongs. The ground through which it would have to be dug, it is asserted, is exactly suited for tunnelling operations, and the sandstone for lining it can be had in any quantity on the Irish side. It is proposed to construct the tunnel for a single line only, the extreme depth being twenty-one feet, and the clear width at the level of the rails fifteen feet. Three lines of rails, to accommodate wide and narrow gage carriages, however, are to be laid. The time estimated for completing the tunnel is about six years, and the coast $21,250,000. To pay a dividend of five per cent, the road should earn $210 per mile per week.

Transmission of Power by Hydraulic Pressure.

Sir William Armstrong, in a paper read before the Institution of Mechanical Engineers in England, states that he considered water in a pipe is preferable for many purposes to shafting, as it is perfectly controllable, and, being uniform in its action, communicates no shocks to the machinery. At present there about six thousand hydraulic machines in use in England, and it is in docks and establishments where there is much lifting, and loading and unloading to be done, that their use may best be seen. Twenty or more cranes may be working at once, unaffected by each other. At the docks at Goole, on the Humber, these hydraulic cranes lift barges containing thirty-two tuns of coal fairly out of the water, to a considerable hight, where they are made to tip their load all at once into a coal-ship lying alongside. Another use for hydraulic machinery is to feed blast-furnaces. These furnaces are now built so big and tall, that the labor of wheeling up the ore and fuel to the mouth would be too severe and costly. The hydraulic lift, when properly arranged, does it by the turning of a cock. By the same simple operation, large holes can be punched through thick solid iron. At Newcastle-on-Tyne, the water-supply, as it runs down one of the hill streets, flows through an engine, and prints a newspaper. In other parts of the same country, all the raising and lowering in the mines is done by water-power.

Process for Rendering Casks Impervious.

The *Chemist and Druggist* states that important result, which has long been aimed at, seems to have been most satisfactorily accomplished by the use of paraffine. Although introduced to the various trades interested only within the past month or two, a long course of experiments has been instituted, for the purpose of fully testing the efficiency of paraffine in rendering casks, vats, and, indeed, wooden vessels of every description, thoroughly impervious to air and moisture.

The result of the investigation has been to establish fully the value of the process, which, we have no doubt, will shortly be generally adopted by brewers, wine-merchants, vinegar-makers, and others; while exporters, dealers, and consumers will all welcome a more perfect preservation of those liquids which are liable to fermentation, or become insipid by exposure to atmospheric influence. Many attempts have been made to secure these ends by means of soluble silicates, varnishes, etc., applied to the casks; but, from many causes, these have been, at best, but very partially successful. Paraffine, as most of our readers are aware, is a substance much resembling spermaceti in appearance, and possesses every requisite to fit it for the purpose required, while it also seems to be entirely free from all properties which would interfere with its service in this respect. The experiments which have been made with this substance in the preservation of meat, indicate its perfect power of preventing all contact of air, while its insolubility in water or spirit, its absence of taste and smell, and its freedom from all liability of cracking, give to paraffine a combination of advantages which can hardly be surpassed for the objects we now refer to. Paraffined casks, while retaining the safety and economy of wooden vessels, are in all respects of cleanliness and non-absorption, equal to glass. They wear longer, are much more readily cleansed, and preserve their contents in better condition than casks not so treated, and thus effect a considerable saving to firms who make use of them. We regard the process as one of considerable practical utility, as well as generally interesting.

Descent of Glaciers.

The Rev. Canon Mosely, in a paper published in the proceedings of the Royal Society, comes to the conclusion, from mathematical calculation, that the weight of a glacier, together with the weight of any snow mass behind it, would not account for its peculiar descending motion at the slopes which are observed. The glacier moves not as a whole, but with different velocities in different parts. "It moves faster at its surface than deeper down, and at the centre of its surface than at the edges." Thus it suffers constant disruption, and the parts are reunited by regelation, as Faraday explained. The displacement of particles one over the other in this motion is known in mechanics as *shearing*, and Mr. Mosely shows that the resistance to this movement is so great that the weight of the mass could not account for its descent; and that some other force much greater, and producing internal molecular displacements, must come into play.

BEET ROOT SUGAR.

No. V.

Technology.—Part II.

THE PRESS ROOM.

Before proceeding with the description of the treatment of the beet root juice after it has left the hydraulic presses, we shall dwell for a few minutes upon some very important, although apparently trivial details, which, for the sake of clearness only, we omitted in our previous article.

Work in a beet root sugar factory being continuous through the day and night, without interruption, it is essential that at least twice during every twenty-four hours, the whole of the press room, with all that portion of the included apparatus which comes into immediate contact with the juice, should be most *thoroughly* cleaned and purified. This is best done at midday and at midnight, when a stoppage of half an hour will generally suffice.

The material used for this purpose is water in large quantity, to which a small amount of slaked lime has been added in order to render it alkaline. Not only must the whole of the stone or marble floor of the press room be thus thoroughly scoured with hard brooms, but also the press tables and their guides, the *monte-jus*, the reservoir for juice, and all other utensils.

The sheet-iron trays must also be scrubbed with a hard brush in hot lime water, in an iron tank, at least twice a week.

The above precautions are absolutely necessary in order to prevent the occurrence of fermentation of the juice, one of the accidents most to be dreaded during the whole process of manufacturing sugar from beets. When once fermentation has taken a foothold in the works, it is generally found to maintain itself there with aggravating persistency, being constantly propagated anew, through minute particles of ferment, remaining in nooks and corners, where they can hardly be destroyed by any amount of labor. Instances are on record where the manufacture of sugar has had to be interrupted for whole weeks from this cause alone.

Cold weather being unfavorable to fermentation, it seldom proves troublesome during the winter, but without necessary precautions, it is certain to be of frequent occurrence during autumn and spring, when the temperature is higher. This same cause precludes the possibility of *profitably* manufacturing beet root sugar during the summer months, which would otherwise be practicable in our Southern States, where two crops of beets can be raised during the year. For the same reason also, the press room must never be artificially heated to over 60° Fah., which will be sufficient to keep the workmen comfortably warm if they wear, as they should, winter clothing and water-tight boots.

In some localities in Europe, where labor is cheap, the pulp is pressed a second time in hempen sacks, after having been sprinkled with water, but in the United States, we believe that it will prove more profitable to lose 1, or even 2 per cent of sugar (which will be transformed into fat in the animals fed on the refuse pulp) than to incur the expense of this second pressing.

Beet root pulp will keep for months in trenches, which are best lined with brickwork, the pulp being compressed into them by means of a rammer, and then covered with straw and a thick coat of earth. It undergoes a partial fermentation after a period of a few weeks, which only tends to make it more palatable to farm stock.

It is fed to cattle, sheep, etc., mixed in various proportions with bran, cut straw, wheat chaff, meal, oilcake, or some other nutritious substance. In order to prevent long-continued use from rendering it distasteful to the animals, it is generally found advantageous to slightly salt it by sprinkling with salt and water at the time of serving it.

Some of the mixtures which are considered the best for the feeding of live stock in Europe, are the following, every twenty-four hours

For fattening an ox: 50 lbs. well pressed pulp, 12 lbs. hay, 3 lbs. oil cake.

For fattening a wether: 8 lbs. pressed pulp, ½ lb. dry fodder.

For feeding a ewe: 2½ lbs. pressed pulp, ½ lb. of dry fodder.

The proportions of these mixtures may, however, be varied by intelligent raisers of domestic animals so as to suit their exigencies.

THE WOOLEN SACKS.

The pulp sacks have to be made of a lax, wide-meshed tissue, the wool having to be twisted and coarse. The part of the fleece generally considered of lowest value for weaving into cloth, is, for our particular purpose, the best, as it is cheapest, most durable, and not so liable to shrinkage, as is wool of fine quality.

The sacks must be washed as often as they become soiled or "greasy." This is done by means of a *sack-washing machine* driven by power, of which many kinds are in use, the simplest of which is a revolving gridiron cylinder, with a central rotating arm-bearing axle.

The water used in all cases must be boiling hot, and contain a certain amount of lime (milk of lime), potash, or soda, in order to detach all fatty or slimy adherent particles. The ammonical waters from the evaporating apparatus may also be advantageously employed for this washing of sacks.

Immediately after leaving the washing machine, the sacks are to be rinsed in clear cold water.

In ordinary winter weather a set of sacks in actual service, will need only one washing and rinsing every six hours, but if any appearances of fermentation are manifest in the press room, or if the temperature of the air be high, they will need more frequent manipulation.

After the rinsing, the sacks are hung up to drip and dry, or the water is pressed out of them by placing them in sets of from five to ten between sheet-iron trays under a hydraulic press.

If the washing and rinsing have been properly performed, the sacks will have no peculiar odor, and will not feel slimy to the touch.

In order to protect the sacks and save the pulp during the operation of pressing, it is necessary to fold them the length of their anterior quarter; thus:

After this, the thickness of the pulp must be equalized by means of four or five strokes given with a short wooden roller. The sacks are laid on the trays with the folded part upward. Practiced workmen spread the pulp with the hand without a roller

The folding and equalizing of the pulp are effected on a small, but heavy side table provided for this special purpose and placed near the presses.

It is important that the sacks should be well shaken out when the pulp is dropped out of them, and that no pulp be left lurking in the lower corners, to effect which it is best to turn them inside out every time they are washed.

The sacks used for the scums (of which we shall have more to say in a future article) are washed, and rinsed in the same manner as the pulp sacks, *at least* twice in twenty-four hours. It is better to do it thrice than twice.

This item, "sacks," is one of considerable importance, as may be judged from the fact, that a factory working 150,000 pounds of beets per day, will send to the washing machine no less than 900 to 1,000 sacks every six hours. Each of these sacks has to be overhauled after rinsing, and the torn or injured ones sent to the *darning room*, where a number of operatives are kept constantly employed repairing damages.

Even with the greatest care taken to keep the pulping drum in right order, and also to seeing that the presses do not rise too fast, the wear and tear in sacks during a campaign are always such as must be taken into account in all calculations of cost of production of beet root sugar.

The price of sacks varies in Europe from 50 to 75 cents, so that we may estimate the first cost of a full set of them, for a 500-acre factory, at no less than $2,000.

The sheet-iron trays are about one line in thickness, and are made 1½ inches broader than the intercalated sacks, so as to avoid protrusion of these last during the operation of pressing out the juice. The angles of these trays must be rounded off, so as to avoid injury to those who have to handle them. About 4,000 trays suffice for an establishment such as we have taken for an example, and would cost $1,000.

The price of a good sack-washing machine and connections is $110.

Total, in gold, for sacks, trays, and washing machine, $3,110.

DEFECATION OF THE JUICE.

After the beet root has been washed, pulped, and submitted to the action of the hydraulic presses (or to that of any other method of juice extraction), the liquid product is, as we have previously stated, collected in a special reservoir.

If the beet root juice consisted simply in sugar and water, the further processes of manufacture would be simple in the extreme, as boiling down or concentration would give us, in one operation, crystallizable sugar; but, as we have shown in Art. II., the sap of the beet root exhibits a long array of contained soluble substances and impurities, all of which have to be eliminated during the subsequent treatment of the juice, necessitating the aid of chemical science in addition to the use of mechanical means.

The various substances to be removed from the beet root juice may practically be divided into two classes; first, those which can be removed before crystallization of the sugar; and second, those which cannot.

The first class of these bodies is, by our modern processes, in a great measure eliminated by the combined action of heat and the use of lime, the operation being known as the "*defecation*" of the juice. During defecation, a certain portion of the sugar combines with some of the lime used, forming a particular body—the *saccharate of lime*. From this saccharate of lime the sugar has to be freed again in order not to be lost by the action of carbonic acid gas, which, having a greater affinity for the lime, combines with it, forming insoluble carbonate of lime, while it liberates the combined sugar, which is then ready for further treatment. This last process is called the "*carbonatation*" of the juice.

We shall now proceed to exhibit in as practical a manner as we can, the ordinary, most simple, and most generally practiced processes of defecation and of carbonatation, and shall follow them, by a summary of the more recent improvements proposed by Perier-Possoz and by Jelinek, the first of these, consisting in a series of successive defecations and carbonatations, and the second in making both of these operations simultaneous.

Defecation is operated in a batch of open circular, round-bottomed pans, known as defecating pans, of which Fig. 1 is a section.

A is the bottom of the pan. B is an outer steam-tight jacket, or false bottom. C is a steam valve through which steam is admitted, between A and B, in quantities to suit the exigencies of the moment. D is the outlet for condensed water and superfluous steam which is returned to the "return boilers." The small cock, shown in the cut, on the right of the false bottom, is for regulating the egress and ingress of air between the double bottom and also for favoring the complete evacuation of the steam. E E is a syphon tube, furnished with necessary cocks and stops, through which the clear juice is drawn off after being defecated.

In many factories, instead of this tube, E E, an orifice closed by a wide-mouthed cock at the bottom of the pans, and opening into a wide funnel, is preferred. Through this funnel the clear juice is at first run off, and is followed by the scums formed during defecation, each of these products being

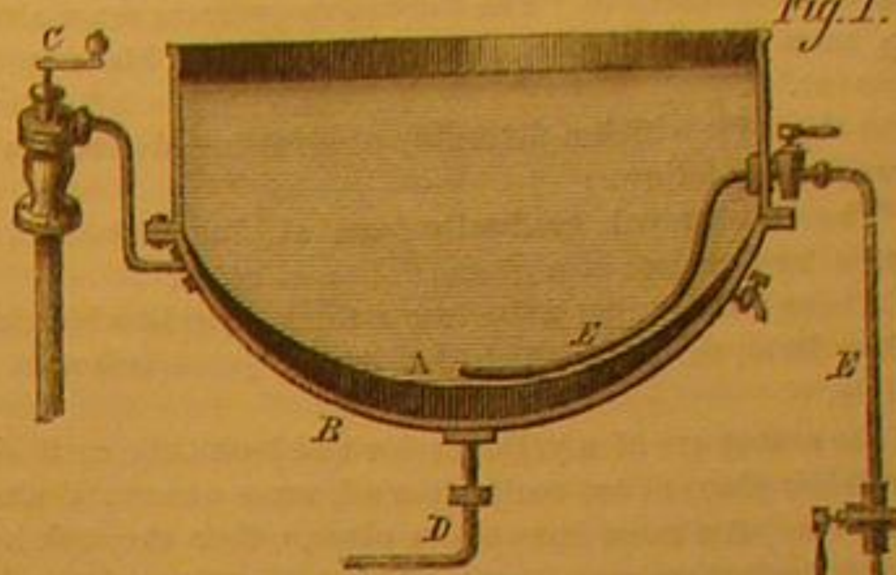


Fig. 1.

conveyed to different departments of the works to be further separately treated. These latter pans are easier cleaned than the first, but the syphon pans furnish a larger amount of clear juice.

The capacity of defecating pans varies according to the quantity of juice worked up in twenty-four hours, but seldom exceeds five or six for the largest works. While defecation is proceeding in some of the pans, others are being cleaned or being filled or emptied in regular methodical order and sequence.

The defecating pans being placed on a higher floor than that of the press room (so as to be above the head of the filters), the juice has to be raised from the lower reservoir to the upper edge of the defecating pans, over which it is discharged through special pipes.

The old plan of pumping up the juice has been replaced in all modern sugar works by the cleanly, simple, and rapid process of steam pressure applied directly to the upper surface of the juice contained in a closed vessel. This is done in an iron boiler, the liquor being conveyed at regular stated intervals of time from the juice reservoir to this boiler, and from the boiler to the defecating pans.

This upright boiler is called a *monte-jus* (literally, mount juice). As quite a number of *monte-jus* are used in all beet root sugar factories, during subsequent operations as well as the present one, we will here give a general description of a *monte-jus*, which will apply to all.

A *monte-jus* must be constructed of strong boiler plate, well riveted, and be sunk into the ground into a cylindrical well-drained brick cistern (the brick work of which must be joined with hydraulic cement, so as to keep out water, and be situated at some little distance from contact with the boiler). The top of the *monte-jus* alone is allowed to project above the floor of the building.

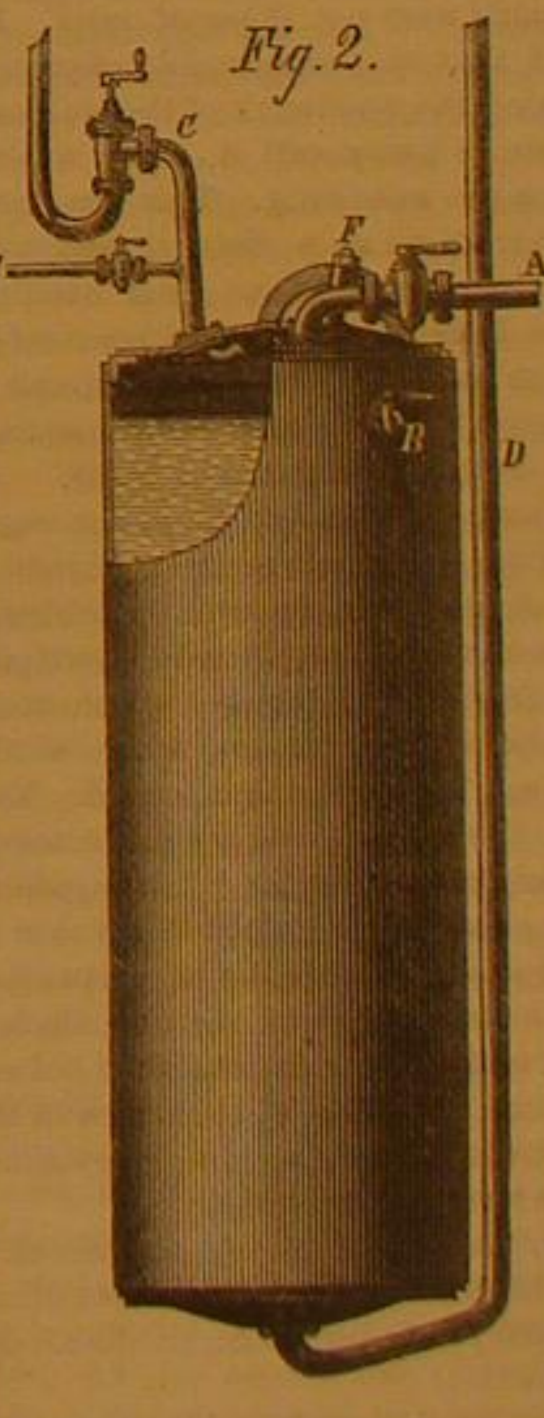


Fig. 2.

In our Fig. 2, A is the pipe through which the juice is admitted from the reservoir of the presses into the *monte-jus*; B is a small cock for ingress and egress of air and evacuation of steam; C is the pipe for admitting steam, its orifice being bent upward so as to cause the entering steam to strike the inner surface of the boiler head; E is the pipe for conveying the return steam to the boilers; F is the man-hole door for cleaning out the *monte-jus*; D is the pipe through which the liquid is forced from the *monte-jus* to the level above, the moment steam is admitted through C, when E and B must be closed.

Every indicated pressure of one atmosphere, or 14·7 lbs., will rapidly raise the juice through a hight of 30 feet.

Monte-jus are often furnished with a steam gage, safety valve, and a float, indicating the hight of the contained liquid.

As soon as a defecating pan has been filled from the *monte-jus* with raw juice to nine-tenths of its capacity, steam is admitted between the double bottom by opening the valve C (Fig. 1) to its utmost extent. The juice is rapidly heated until it reaches temperature of from 174° to 185° Fah., a fact which practiced workmen appreciate without a thermometer by merely dipping their fingers into it, and by the aspect of the numerous minute particles of coagulated albumen which are present in it. This temperature is just bearable to the hands without scalding.

At this moment, milk of lime, prepared from very pure lime, is poured into the warm juice, and well stirred into it.

Steam is allowed to continue entering the space between the double bottom with full force, until a layer of scum of the thickness of a finger has formed on the surface of the juice, when the valve must be closed little by little, but in such a gradual manner that just as ebullition declares itself in the liquid the steam must have been cut off to one-quarter of its original quantity. This last portion of steam is itself to be suddenly suppressed, as soon as ebullition and consequent termination of defecation indicated by a sudden irruption of clear juice on the upper surface of the scums, have manifested themselves. The defecating operator must always be a man of experience, as much is left to his empirical judgment.

The signs by which a favorably-progressing defecation are known, are as follows:

1. The scums must gradually form at the surface of the juice, in large flakes of a greenish-brown color.

2. These flakes must unite into a thick layer in which large crevices form, through which the limpid juice below is discernible.

If the scums are of a yellow color and look thin, or if ebullition takes place at too early a period, some unnatural alteration in the juice must have taken place, either through heating or putrefaction consequent on the thawing of the beet root, or through the action of fermentation brought on by impure water left in the reservoir or in the *monte-jus*, or lastly, by the use of imperfectly worked sacks.

In our next article, we shall give an account of the mode of preparing the milk of lime used in defecation, and the manner of "dosing" it to the juice. We shall also attempt to give a general idea of the *rationale* of defecation, and proceed to explain the necessity for carbonatation and the mode of effecting it.

The estimate and valuation in gold for the defecating department of a factory for working 150,000 lbs. of beet root every twenty-four hours, is as follows:

Three copper defecating pans, with cast-iron false bottoms, with all their special fixtures, cocks, valves, etc., same capacity as *monte-jus*. Cost, $1,320.

Copper feed pipe, with three cocks for juice, and iron pipe with three cocks for water for washing out pans. Cost, $100.

Total, for a defecating department of a 500-acre factory, $1,420.

Correspondence.

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

The Singing Mouse.

Messrs. Editors:—It was in the summer of 1867, when I was seated near where the casing of the water pipes passed up through a closet, that I heard what I supposed to be the twittering of a brood of chimney birds within the casing. Some days afterward the cook reported that there was a large nest of mice in a box of fuel near the range in the kitchen. We were at dinner, and I passed out to capture and kill the pests Listening to the sounds, I again pronounced it a brood of birds that must have fallen down with their nest from an adjoining chimney, as the sounds were not those of mice. Removing everything, I found that the sounds did not proceed from the box, but were behind the woodwork of the wall near the floor. Nor did the music, as I may call it, cease when I made several hard raps upon the woodwork. This convinced me that the sounds had their origin at a distance, and were conveyed to that point as through a tube. That evening, when I passed round to see if all the house had been safely closed, the music appeared to be in a different locality, and as all was still, I studied attentively the character of the sounds, and became convinced they were not produced by birds.

On my making a disturbance it ceased. Thus the music continued for two or three days, when one evening I heard it in the china closet of the dining-room, apparently behind a tray on the shelf. But in removing some plates to investigate the matter, the shuffling frightened a mouse, which made good its escape away from the tray and ran into a hole at the corner of one of the shelves. The music then ceased. This was not positive proof that the mouse was the performer in the singing. On the next night I heard the music again in the same place, and having previously adjusted the dishes to suit me, I supposed I would easily capture the musician; but the cook had re-adjusted the dishes, and in shifting them a mouse had again run away, and the music ceased as before; fortunately, however, this time the music was resumed in the place into which it had retreated, affording ample evidence that that the mouse was the author of the music.

The mice being annoying, the cook, next day, introduced a cat into the cellar, and, on the following night, the mouse had retreated up the chimney flues to our bed-room, on the second floor above the dining-room.

About two o'clock A. M., on awaking, I heard the music distinctly proceeding from the hearth beneath the grate. It was loud enough to be heard throughout our large bed-room. My wife, who had been ill and unable to go down to the dining-room, had doubted our reports; but when I awakened her, she sat up for more than an hour, completely fascinated by the little songster.

On the next night a suitable trap was set and the mouse was captured without injury, but unfortunately, it escaped while we attempted to remove it to better lodging. One very peculiar trait in its character was, that it continued to sing during the whole time it was a prisoner.

On the next night it was again captured and safely disposed of in a secure cage with a wheel.

The cook reported another singing mouse in the kitchen, and a new and elegant cage was procured for our little captive. Its musical notes were identical, as near as we could judge, with the warbling notes of the canary bird. At times, only a single note would be sounded, and after a pause the performer would dash off its warbling notes for hours—even for nearly half a day. Then it would cease and rest, sleeping, perhaps, as it retired to its bed.

This cessation of singing for hours, proved that its performances were not *involuntary*, from a diseased condition of the throat, as has been conjectured in other similar cases, because it could sing and cease from its music at will.

In the wheel of its cage the singing was somewhat interrupted by its efforts, and was not so perfect as when the mouse was in the cage itself. When it appeared to become fatigued with the effort of turning the wheel, sympathy was enlisted in its behalf and the wheel was tied so as not to revolve. This was a fatal mistake, as the mouse then began to nibble at the wires of the wheel in trying to escape. The wires had been painted with white lead, and the mouse was poisoned, and died, to the great grief of the family. It now stands in the parlor, under a glass globe, being neatly set up by a taxidermist. David Christy.

New York city.

Testing Boilers.

Messrs. Editors:—Justice to a class of men known as inspectors of boilers, selected for their acknowledged skill and experience in practical engineering, imperatively demands an answer to your correspondent "J. H. L.," with a view to refuting his arguments on page 182, current volume. As he does not hurl his thunder against any particular division of boilers, I take it for granted that steamboat boilers are meant also.

First, his statement that boilers are subjected to a hydraulic (hydrostatic) test of two hundred pounds, and allowed a steam pressure of eighty pounds, is incorrect, as a simple reference to the steamboat law will show; for the proportion there established is as 165 is to 110; or plainer, the hydrostatic exceeds the steam pressure by one-half; whereas two hundred pounds exceeds eighty pounds two and a half times. I fully concur with him in that this excessive pressure would greatly weaken the boiler, if it were applied, but happily such is not the case. Second, the temporizing, of which he so loudly complains, may be a distinguishing feature of his locality, but in most, if not all, of the ports of inspection it has no being. Lastly, the condemnation that he pronounces upon the test, serves but to show his unacquaintance with its history; for the large reduction in disasters from this cause amply proves the correctness of the theory. And the method of examining the boilers internally and externally is not original with him, and is practiced by inspectors after the test. I can assure the gentleman that nothing can make up the deficiency or carelessness of the engineer, whether it is attempted in the shape of laws or safety appliances to the boilers. Let an employer secure the services of an attentive, skillful engineer, and, my word for it, all will be well, and nothing will be heard of incompetent inspectors and excessive tests.

James Butler.

New Orleans, La.

[We do not see how the temperate communication of J. H. L. should arouse so harsh a spirit in Mr. Butler. J. H. L.'s article appears to be merely suggestive and advisory, and in no sense arbitrary or combative. The facts he stated are too well established by experience and observation to be overthrown by the style of attack chosen by Mr. Butler.—Eds.

The Law of Steam.

Messrs. Editors:—The formulæ for determining the latent heat of steam from the temperature indicated by the thermometer, given incidentally by me in my article on the "Law of Steam," published in the last issue of the Scientific American, and which I took from John Sewell's well-known treatise on "Steam and Locomotion," are incorrect, and as such, liable to lead persons who are not familiar with the theory of latent heat into error.

I take this first opportunity of putting the matter right by furnishing the true formulæ as they should have been stated.

To find the units of latent heat in steam when the thermometric indications are known, use the following:

For the Centigrade scale, $T \cdot 305 + 606 \cdot 5 - T = L$.

" Fahrenheit " $(T-32) \cdot 305 + 1123 \cdot 7 - (T-32) = L$.

In both of which T is the observed temperature of the steam, and L the latent heat.

The number of 17 Centigrade units, which I have given as the *approximate* difference between two terms of the arithmetical progression of my law of steam, being supposed correct, the corresponding figure for the Fahrenheit scale ought to be $17 \times 1 \cdot 8$ or 30·6 Fahrenheit units.

I find, after a careful comparison of the mean pressures and corresponding temperatures *observed* by the Franklin Institute Committee, that the result of their numerous experiments indicates a general average of 30·7 Fah. units, showing as highly satisfactory accordance between the deductions of my theory and their practical results, as I had previously found to exist in regard to the experiments of the French Academy and of Regnault.

J. M. Deby.

A Challenge to Watchmakers.

Messrs. Editors:—My second challenge to watchmakers is founded on simple, well-known facts, clearly explained in the following:

First, correct poise requires the balance to be poised in its place in the escapement. Second, vibrations of variable extent, in equal motive force, cannot keep their rate unless they are isochronal. Third, equal extent in the vibrations is impracticable in contrary positions of the watch. Fourth, opposite positions must be used in the process of poising balances.

This challenge is intended for all pocket chronometer makers, to the effect that they cannot poise their balances properly, unless they have friction isochronism in the escapement ("isochronal hairsprings" or not), for two reasons: one is the variable resistance to the motion of the balance, in the opposite positions of the movements while testing its equilibrium; the other reason is the variable impulse in equal motive force, such as results more or less from imperfect unlocking in a different position, striking the pallet upward, etc.

As a general thing, all causes (variable and capricious frictions, and variable impulse to the balance) of change in motion, in which the mainspring has no part, have the same effect as altered friction, and like the latter, come under the control of friction-isochronism.

The balance may be exactly poised to suit the circumstances of a case, but as soon as these foreign influences change (neutralize each other, or act in concert), the balance will show defective poise. It is therefore explained that the resistance and impulse effects must be isochronalized before the poise process can be begun. J. Muma.

Hanover, Pa.

Finish of Paper Collars.

Messrs. Editors:—Some time since you noticed the receipt of a linen-finish paper collar that had been blackened by sulphureted hydrogen. You said that should not be taken as a conclusive test of the presence of lead, but other tests should be applied. I inclose a cuff on which I placed a drop of solution of bichromate of potassa, which appears to indicate the presence of lead by the formation of chrome yellow, as is shown by the contrast between that and the pale yellow spot caused by the bichromate on the "unfinished" side. A piece of the "finished" surface also gave a yellow incrustation when heated on charcoal before the blow pipe, but failed to do so when heated in the same manner with carbonate of soda.

Charlotte, Maine. H. A. Sprague.

[There is no doubt that the specimen inclosed by our correspondent contains lead.—Eds.

A Valued Testimonial.

Messrs. Munn & Co.:—In token of my appreciation of your valuable services to my house, as a reliable medium to procure patents, I feel it not only a pleasure, but a duty due to you, to say that within the past four months I have made application for nine patents through your office, and in every case you have been successful. The fidelity and honesty with which you have treated my business, together with the gentlemanly courtesy which I have received, not only from the heads of your house but from all your large staff of employés, in your New York as well in your branch office in Washington, constrain me to send you this. The character of your business is too well established to require any further testimony, but if this can be of any use, I shall be pleased. With my best wishes, Yours respectfully,

Charles Pratt.

108 Fulton street, New York, March 26, 1869.

[The above is from of one of the largest dealers in, and canners of oil in the country, and the patents referred to pertain solely to his business. Mr. Pratt's facilities for transacting business are such that he can make 10,000 cans, and fill, seal, and ship 50,000 gallons of oil per day. The value of the solder consumed in this concern amounts to $20,000 annually. Every kind of oil is dealt in by Mr. Pratt, and any package, whether illuminating or lubricating oil, bearing his trademark, can be relied upon as being all it is represented to be. His advertisement may always be seen in our columns, to which the reader is referred for further information.—Eds.

For the Scientific American.

GRAVITATION THE ORIGIN OF THE HEAT OF THE SUN

Having traced back in a former article (page 198) the source of all motion and of all life on our planet to be the heat of the sun, the answer to the question as to the source of this heat, becomes of still greater importance than it has ever been. Considered from this point of view the solar heat is an enormous motive power, stored up when the solar orb was formed, by the very act of its formation, and now this power is gradually returning into space, carried forward by the radiation of the sun's rays; here and there this power reappears in the form of motion, on the surface of some planet where the conditions to this transformation are favorable.

I attempted in the former article to point out that, as chemistry has taught how matter shows itself to us under the most varied forms, and undergoes the most surprising transformations in its properties, even so the modern investigations in regard to force have proved that, being nothing but matter in motion, force will show itself also under different forms, and also undergo astonishing transformations, from motion of masses to molecular motion, the last of which may be vibratory, rotatory, etc., and produce the phenomena of heat, elasticity, etc.

It has also been proved that just as matter is indestructible, so that not an atom can be created or destroyed by man, even so force (matter in motion) is indestructible, and that not the least trace of force can be created or destroyed by man; and like as the universe contains a certain measured amount of matter, so also it contains a certain measured amount of force, which means that even as the sum total of all matter is a constant quantity, so also the sum total of all force or motion is a constant quantity.

I wish now to point out how a modification of the nebular hypothesis of Laplace will explain consistently the origin of the sun's heat, in accordance to the present state of our knowledge in regard to the relation between heat and force, and the convertibility of one into the other.

Laplace supposed that all matter in the universe was once in a state of vapor, or was a nebula, and that by cooling it had contracted; and thus by further contraction formed the sun, stars, planetary systems, etc. This hypothesis presupposes the previous existence of an enormous high temperature, as well as the existence of the matter, the loss of the heat by radiation, the contraction subsequent on cooling, etc. When we, however, accept nothing but the existence of matter and of gravitation urging this matter to coalesce in diverse common centers of attraction, and apply to this supposition our present knowledge of the change of apparently destroyed motion into caloric, Laplace's hypothesis is at once elevated into a theory, and we may accept that when matter, at first diffused in the universe, and, urged by gravitation, commenced to coalesce in different centers of attraction, and had there this motion destroyed by opposing forces (viz., matter falling in opposite directions), the visible motion of the masses had necessarily to be changed into molecular motion, viz., heat.

When now we take in consideration the enormous amount of matter falling together, and the almost immeasurable distances through which it fell, and apply to it the rule proved by modern mechanics, that the falling of 760 pounds 1 foot, or 1 pound 760 feet, will produce one unit of heat, the number of units of heat produced at the formation of sun and planets must have been so immense that it takes thousands of millions of years to cool such large masses, raised to so high temperatures, by radiation, a process which has been going on in the planets, as is proved in regard to our earth by geology, and as also is going on at present, as we know in regard to our sun by daily experience.

The old hypothesis of Herschel, still also copied in some of our school books, that the sun is a dark, cold, solid body, surrounded by a luminous atmosphere, is utterly disproved by the investigations by means of the most valuable inventions of our decade—the spectroscope. Indeed, this instrument has not only proved that the sun possesses a high temperature, but also that this high temperature is not the result of a permanent combustion, like the high temperature on our earth (excepting volcanic fires), and also that this temperature is so high that most substances solid on our earth are surrounding the globe of the sun as an atmosphere in the state of vapor, as some of our metals, iron, nickel, sodium, etc.

The ideas here presented were fully developed by the writer three years ago, before the American Institute, New York City, in a series of three lectures on the universe, its past history, present condition, and its probable final fate, which lectures are found in the Transactions of the Institute for 1866.

If, then, the law of gravitation is the sole source of the sun's heat, and also of our ocean tides, and the sun's heat the cause of all motion on our planet, we must come to the conclusion that the simple and single law of gravitation once acting mutually between particles of matter dispersed in space, is the primary cause of all other forces, and that all the complex actions of life and other motions on the surface of our earth, being traceable back to the simple law, are only gravitation in disguise. P. H. VANDER WEYDE, M. D.

Causes of Steam Boiler Explosions.

It is certain that any information as to the circumstances of steam boiler explosions, even if it does not give the causes, is valuable. We copy a few remarks from the fourteenth half-yearly report of the Chief Engineer of the Midland (Eng.) Steam Boiler Inspection and Assurance Company, which may be of real use.

"At the end of the year 1868, 1,103 boilers were under inspection, and 1,530 under assurance, making a total of 2,633. These boilers were used for the following purposes: 1,238 in collieries, 1,156 in ironworks, and 239 in mills of various kinds. The boilers were of the following general description: 2,205 fired externally, and 428 fired internally.

"During the year, there have been made 11,900 inspections of boilers, 1,483 of which have been internal, and 1,361 in the flues, and 1,656 reports have been sent to the owners. The following brief epitome of the chief points referred to in these reports may be of general interest:

"The point of first consideration is the general construction or repair of the boilers, and the arrangement of the flues. Many boilers have been taken out as not being fit for the required pressure. Some or these have been discarded because the plates were arranged lengthways in the boilers, producing in the weakest position, long, straight seams without any crossing of joints. In some cases this weakness has been increased, by the inside lap of each plate being so small, that the rivet holes were almost at the edge of the plates. The flat ends of boilers have been frequently found insufficiently stayed, especially were tubes have been removed, and it has been at times difficult to convince owners of the danger of this, although the ends have been shown to be bulged from weakness. Some few machine-made boilers have been found quite unfit for use, simply because the work was inaccurately done. There is no question, boilers can be well made by machinery, but if the work is placed carelessly, so that the plates do not meet, or the rivets are not struck fairly, the boiler cannot be made sound. Boilers are constantly noticed needlessly weakened in order to obtain the doubtful benefit of a dome, especially where the hole in the shell is its full diameter. One small boiler (9 ft. 6 in. by 3 ft. 6 in.—30 lbs.) was pierced with so many holes for fittings in one line on the top, that more than one-half the strength of the shell was lost.

"Boilers of good design and safe proportions are frequently made insecure by injudicious alterations. Tubes are taken out without any compensation for the loss of strength, and stays or tie-bolts are allowed to get slack. This has been more particularly noticed in upright furnace boilers, where new bottoms have been made nearly flat instead of hemispherical, causing a new strain on the angle iron and on the old work. In a somewhat similar way, mischief is often done by altering the arrangements of the puddling furnaces, or by substituting large mill furnaces, so that the boiler is exposed to more heat than the metal can transmit, or the water convey away in the shape of steam, and the plates become injured. Sometimes the exact contrary is done, and a furnace is discontinued, and half a boiler is exposed to cold air, while the other is furiously heated, causing a new and unequal strain.

"Sometimes internal tubes have been found forced out of the circular shape, for want of strengthening rings or other means of security. Manholes have been found in a dangerous state from want of guard rings, the edges of the plates having perished or cracked, rendering it impossible to make a good joint, and the continual leaking has made the matter worse. Serious complaint has had to be made of some of the workmanship in repairs, by which boilers have been nearly ruined.

"Corrosion has as usual proved a serious evil. Suspicion was entertained that corrosion existed on the side of a plain cylinder boiler (22 by 5—16 lbs.), from its peculiar position below the surface of the ground, and on the brickwork being removed, the plates were found so dangerously thin all along the side, that holes were knocked through them with a light hammer. Some boilers have worked a long time with a brick covering to prevent radiation, corrosion was suspected beneath, and on removing the covering, every plate was found so thin as to make them quite unsafe. The tops of some plain cylinder boilers were frequently found wet from the leaking of the fittings and feed pipes, and as it was known that this could not continue without causing mischief, examination was urged, and the most dangerous corrosion was found, in boilers which ought to have worked many years longer without repair.

"A vast number of safety valves are found needlessly overloaded, while the steam gages are often out of order and inaccurate. As the gages become only gradually defective, the evil is not seen unless they are trusted long after they are incorrect. The habit of putting them on the steam pipes, where the pressure is always varying, causes them unnecessary wear. It is always best to have one attached close to each boiler, but where they must be in the engine house, or one has to serve for several boilers, they should be attached by separate pipes. It would often lead to great improvement, in the duty of engines working night and day, if the steam and vacuum gages were self-registering."

Poisonous Dyes.

At a recent meeting of the Académie Impériale de Médecine, M. Tardieu made a communication touching the poisonous action of some modern dyes. He reminded his hearers that M. Cerise had confirmed his former statements respecting the poisonous nature of coralline, by calling the attention of the Académie to a case of such poisoning produced by wearing socks dyed with this substance; and said further, that Dr. Despaull Ader had a marked case of the same kind, which, however, had not been published. Another case of a little girl who had suffered from the characteristic cutaneous eruption, brought on by wearing some garments dyed with coralline, of English manufacture, had been brought under his notice by Dr. Michalski, of Vierzon. These cases are examples of a special kind of poisoning, by means of a special poison—coralline—and are to be carefully kept distinct from other cases of a different kind, which M. Tardieu referred to. He mentioned that Dr. Viaud Grand-Marais, Professor in the Medical School of Nantes, had met with a case in which the poison contained in a dyed shirt was not coralline, but magenta, the well-known aniline-red. The poison in this case was the arsenic contained in the magenta, so that, strictly speaking, it was an example of arsenical poisoning. M. Tardieu called attention to the well-known fact of the employment of arsenic in the manufacture of magenta, and remarked that, despite all processes of purification, this dye almost invarably contains arsenic. In order to facilitate the collection of information relative to poisoning by means of dyes, and to avoid confusion, M. Tardieu gave a brief *resumé* of the distinctive chemical characters of the different organic red dyes to be met with in commerce. These dyes are six in number—garancine (madder), cochineal, murexide, carthamine, magenta, and coralline. The first three cannot be used in dyeing without a mordant; the last three are taken up by woolen or silk fabrics without it being necessary to employ a mordant. 1. Garancine (madder) is the most fixed of all the organic red dyes; it is not altered by a solution containing three or four per cent of hydrochloric acid or of ammonia. 2. Cochineal is turned violet by ammonia, and, at the same time, communicates a bright violet color to the ammoniacal liquid. 3. Murexide is bleached by citric acid. 4. Carthamine is decolorized by a short boiling with a weak solution of soap (about one part of soap in two hundred of water is enough). 5. Magenta is decolorized by ammonia. 6. Coralline is not diminished in intensity by contact with alkaline fluids. It is dissolved off the fabric by means of boiling alcohol, giving a red liquid, which is *intensified* by ammonia or potash, a character which at once distinguishes it from magenta. At the same meeting of the Académie, M. Chevallier observed that the confectioners who had been in the habit of coloring bon-bons with magenta, had received orders to substitute some other dye for that purpose.

Mr. Wanklyn, whose communications respecting the dangers of the modern dyes will be remembered, and who was, we believe, the first to point out the danger of arsenical poisoning, by means of magenta-dyed underclothing, writes to us to say that a composite dye is now very much in vogue, consisting of magenta, tinted with some orange-coloring matter. This dye, a splendid scarlet, very much used for underclothing, is doubly poisonous, and exposes the unfortunate wearer to the risk of being poisoned by arsenic, and the risk of being poisoned by an irritant orange dye.

The Great Pyramid.

The accurate measurement of the sides of the Great Pyramid, says the *Public Ledger*, is still attracting attention, and the result of the labors of the party of Royal Engineers of Great Britain, now engaged in this work, is waited for with much interest. The surveys, if correctly made, will settle many interesting points in reference to the units of lengths used among the ancients. Thus Herodotus states that the Egyptian cubit is equal to the Grecian cubit, and that the Great Pyramid has sides exactly five hundred Egyptian or Greek cubits in length, and covers exactly twenty-five aruræ or Egyptian acres, the arura containing one thousand square cubits. Again, the Parthenon at Athens, according to other historians, gives the Greek units of length, and by modern measurements of this ancient building, the mean length of the Greek foot is 12.149 inches, and of the Greek cubit 18·224 inches. Multiplying the cubit thus ascertained by 500, the length of the side of of the Great Pyramid should be 9,112 inches. The mean length of the side of the Pyramid as obtained by examining the structure itself, is calculated to be 9,110 inches, and thus a reasonably accurate standard of ancient measures has been fixed. The difficulty in the way of arriving at the true results is greatly enhanced by the fact that the casing stones of the Pyramid have been removed. The sockets cut in the rock to receive the corner blocks still remain, and the calculations as to the actual width of the casing stones are affected by errors arising from this source.

Fiber of Cocoanut Husks.

The method of converting cocoanut husks into useful fiber, is thus described in the *Mechanics' Magazine*:

The shell, or outer covering of the nut, is first soaked in a tank of water kept warm by steam. When sufficiently soaked, the shells are conveyed to a hopper, through which they are fed to a crushing mill, which consists of two coarsely-fluted rollers, between which the shells pass and are crushed. They are removed thence to the fiber mills. Here the shells are drawn in between two rollers, behind which are arrangements for tearing away the finer fiber and leaving the coarser in the hands of the operator, who presents first one and then the other half of the shell to the action of the mill. The coarse fiber is then carried away and prepared for conversion into brushes and brooms. The finer portions of the fiber are removed from the mill, and undergo a process of final dressing. This is effected by feeding them through a hopper into a circular screen, in which an Archimedean screw rapidly revolves. The fine fiber is delivered at the mouth of the screen, while the dust and smaller particles of fiber are carried through the sieve. The fiber thus produced is used for making mats and matting; the siftings find a ready sale with florists and market gardeners, for manure. The sweepings and refuse are collected and burned under the boilers.

Welding Powder.

A powder of the following composition, recently patented in Belgium, is said to be very useful for welding iron and steel together. It consists of one thousand parts of iron filings, five hundred parts of borax; fifty parts of balsam of copaiva or other resinous oils, with seventy-five parts of sal-ammoniac. These ingredients are well mixed together, heated, and pulverized. The process of welding is much the same as usual. The surfaces to be welded are powdered with the composition, and then brought to a cherry-red heat, at which the powder melts, when the portions to be united are taken from the fire and joined. If the pieces to be welded are too large to be both introduced at the same time into the forge, one can be first heated with the welding powder to a cherry-red heat, and the others afterward to a white heat, after which the welding may be effected. Another composition for the same object, consists of fifteen parts of borax, two parts of sal-ammoniac, and two parts of cyanide of potassium. These constituents are dissolved in water, and the water itself afterward evaporated at a low temperature.

LIQUEFACTION OF GASES.—Mr. Ladd has lately exhibited at the Royal Institution, London, a very elegant experiment, showing the liquefaction of gases by pressure. Three glass tubes, open at the bottom, containing cyanogen, sulphurous acid, and ammonia in their upper parts, and filled with mercury below, are inclosed in a strong glass cylinder filled with water. At the top of the cylinder is a small force-pump, which, when worked, drives more water into the cylinder, and forces the mercury, which acts as a piston up the tubes. As the mercury rises the gases are condensed, and now appear as liquids at the top. When the pressure is reduced by opening a stop-cock the liquids boil, and the gases speedily resume their normal dimensions.

A MONSTER BLAST.—A blast of unprecedented magnitude was recently set off at Smartville, California. The tunnel in which the enormous charge of powder, no less than 1,200 kegs—was placed, has been some time in progress. It was 570 feet in length, and undermined a mountain which it was desired to shatter for purposes of hydraulic mining. The charge was ignited by an electic wire, a romantic young lady being the one chosen to perform the task. The mountain was thoroughly shattered in the presence of thousands of people collected to see the novel sight.

Improved Style of Two-Wheeled Velocipedes.

Some time ago we intimated that the perfect velocipede was yet to be built; since then we have secured patents on a number of improvements, not possessed by any of their predecessors, and thus the point of perfection is being attained. The one represented in the accompanying engraving is well worthy the attention of velocipede riders and builders, for its simplicity of construction, cheapness of cost, ease of management, and adjustability for suiting the size and strength of the rider.

The frame is of hollow pipe, the rear being a complete circle in which the steering wheel rotates on its axis, the driving wheel running between the parallel bars of the front portion. The axle of this wheel passes through boxes secured to the parallel bars by set screws, so it may be adjusted forward or back to suit the *physique* of the rider. The axle of the steering wheel runs in boxes secured to sliding bars curved to fit the inner diameter of the circular portion of the frame, thus allowing this wheel with its axle to perform an entire revolution within the frame on a horizontal plane. Its movements are controlled by means of rods attached at one end to the ends of the axle, and at the other brought together to the lower end of a lever directly under the rider's seat, the handle of which comes up in front of the rider, the fulcrum being on a cross piece between the rear portion of the parallel bars, serving not only that purpose but that of a brace. It will be seen from the figure that the guiding of the vehicle may be effected by one hand. The seat need not be so high as represented in the engraving; it may be lowered until nearly to the level of the reach, which is the horizontal line of the axles.

MC'DONALD'S ADJUSTABLE BICYCLE.

Such a vehicle is easily and cheaply constructed, and will operate with ease. The reach, which in the ordinary bicycle extends in an upward curve from the level of the rear axle to the top of the driving wheel, is easily made, while in others its forging adds greatly to the cost of the vehicle. In mounting the ordinary two-wheeled velocipede the rider must spring from the ground to a hight not easily reached by persons of obesity or of sluggish habits, and the danger of damage to both rider and vehicle is greatly enhanced by hight from the ground. If overturned, this machine cannot fall upon the rider, as the circular formation of the rear portion forbids a complete inversion. The danger of overturning this machine is still further diminished by the weight of the rider being brought nearer the center of suspension, as his seat may be brought very near the horizontal line of the axles without preventing or interfering with the action of his legs. The ease of guiding is sufficiently clear by an examination of the engraving, where the rider is shown as using only one hand for this purpose.

Patent pending through the Scientific American Patent Agency by C. E. McDonald, who may be addressed at Amsterdam, N. Y.

CULTIVATION OF THE POPPY AND MANUFACTURE OF OPIUM.

We are in receipt of inquiries in regard to the cultivation of poppies, and the manufacture of opium; it having been suggested by certain agricultural journals that there are various parts of the United States where this industry might be profitably introduced. The failure of several attempts which have hitherto been made to produce this costly drug in America, is justly considered as an insufficient reason for supposing it impossible to succeed in other parts of the country possessing more favorable circumstances of soil and climate.

The opium, which finds its way to European and American markets, is raised principally in India, China, and Persia. The climate of these parts of Asia seems peculiarly adapted to the growth of the species of poppy (*papaver somniferum*), from which opium is obtained; accumulating in the juice of the plant the peculiar substances which form the complex compound called opium. The latter is the dried juice of the plant obtained by tapping the capsules, which allows the juice to flow out and stand in drops upon the surface from which it is scraped with knives when it is dried sufficiently. Another method, that of dissolving out the remainder of the juice after tapping, with water, and evaporating the solution has been also practiced to supplement the former.

Each capsule will yield opium only once by tapping. The tapping should be performed a few days after the flower has fallen, and the incisions should be made horizontally, and not so deep as to cut into the inner portion of the capsule, as should this happen, the juice would flow into the cavity and be lost.

Various experiments have been made in England, France, and Scotland, to produce opium, with encouraging results. So far as our knowledge extends the attempts made here have not given much encouragement of final success.

The poppy will grow luxuriantly in almost any fine rich soil. It may be sown in hills sufficiently wide apart to admit of cultivation, and harvesting the opium as the capsules mature. Experiment alone will suffice to determine what soils and what section if any in this country will answer well for its cultivation, and what quantity of seed will do for a given quantity of land.

We see no reason to doubt, that in the very diversified conditions of climate and soil to be found in the United States, there may be some sections well adapted to the culture of opium, and thus another drain upon the resources of the country be cut off by home production.

SHAFTING, PULLEYS, AND BELTS.

NO. II.

In our former article directions were given in regard to the preparation of the shaft sections for turning. The shaft having been centered and straightened is now ready for turning. Whatever may be the diameter of the shaft proportioned to its length, it should be supported about midway of its length by a rest secured to the ways of the lathe. Before adjusting this rest, however, the ends of the shaft should be squared up to the center hole with a side tool. If the vise centering was properly done, there is little danger of throwing the center out of true by this process. If so, a hand, half-round, conical-pointed reamer may be used to scrape the edge of the center hole until the shaft turns true. A good form of center rest is shown at Fig. 1, a front view. It is a casting in a circular form, with three equidistant projections for the reception of the bearing slides, shown in dotted lines in Fig. 1, and better in view, Fig. 2. These slides are simply plain castings with a slotted hole through their centers calculated, or filed to fit the recesses in the radial channels.

Fig. 1

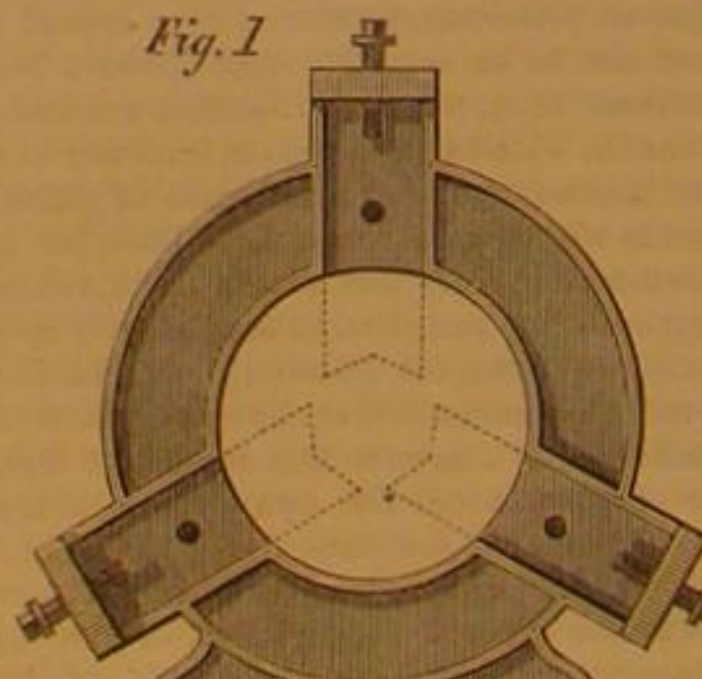


Fig. 2

Fig. 3

Fig. 3 is a thimble fitted with three set screws at each end, placed equidistant, and set up when the thimble is on the shaft until its turned surface between the collars at either end runs perfectly true. The use of this thimble is much better than hand-tooling or filing a place on the shaft at the middle to receive the bearing slides directly upon the shaft, as it is impossible to get the shaft perfectly round, owing to its springing. In lengths of shafts of small diameter, as one-and-an-eighth, or perhaps even one-and-a-half inches two of these rests may be advantageously employed. Sometimes, also, a follow rest attached to the carriage is used, but in practice we have not found this plan desirable; the friction is very great and the care of the tools, even in the first cut, is considerably enhanced.

The follow rest is simply a modification of the center rest, its main difference being that it is bolted to the carriage and moves with it. Some use, with the follow rest, a hardened steel thimble, bored to the finish diameter of the shaft, and sliding with the carriage. Its use is to be reprehended for its costliness, wear, close attention required, and other reasons apparent to the thinking workman. We prefer to do without the follow rest in turning shafting; the center rest is sufficient and preferable.

When the shaft is turned to a point as near the fixed center rest as the carriage can run, the lathe is stopped, the rest moved to the other side of the carriage, secured, and adjusted, and if the shaft is decently turned the thimble may be dispensed with, and the bearing slides of the rest brought directly against its surface. Some prefer to turn and finish the shaft at one operation by using two tool posts and a diamond point and a square nosed chisel at the same time. It is doubtful if anything is gained by this combination. All rolled bars—excepting the cold rolled shafting mentioned in the former article, which requires no turning whatever—are more or less out of round, and consequently the first chip is an uneven one; so if the finishing cutter is attached to the same carriage as the roughing tool, it will partake of the carriage's vibration, a vibration, however small, necessitated by the unevenness of the shaft's surface, and certain to leave the shaft out of round

Shafting is turned very rapidly by a method practiced in many shops of having a high auxiliary tool post at the back of the shaft, and a little in advance of the front one on the carriage. In this back post is secured a reversed diamond point that acts as the roughing tool. Other workmen discard entirely the use of the diamond point, and employ instead, a side, or squaring-up tool, setting it at an angle of about 20° to the shaft. Neither of these plans do we admire in practice, although employed by many first-class mechanics. Still, each is free to follow his own whim in this respect.

When couplings are turned on, the shoulder should be as light as possible, in order to retain the strength of the shaft. The key-ways should be milled or planed rather than chipped, as blows may spring the shaft. The couplings, bored, reamed, splined, faced, and turned, should be again faced after being seated and keyed on the shaft.

The pulleys should be chucked and trued by their outside perimeter, without regard to the hub or its cored hole. The old-fashioned way of chucking a pulley on an extemporized chuck of hard wood plank, secured to a face-place, has its advantages. In this case the face of the chuck is turned true, having a hole through the center for the reception of the hub and the passage of the drill and reamer, and a number around the circumference of the pulley for the reception of bolts. These bolts should be made hooked, instead of headed, for the embracing of the rim, and should be screwed up on the back with washers and nuts. We must say that this method of chucking pulleys for drilling seems to us more satisfactory than by the use of the scroll, or a universal chuck. The pulley has a bearing against the wood that appears to be superior to that on an iron chuck, and when once secured in place the pulley cannot be moved out of true.

Pulleys are, of course, turned on an arbor. The edges of the hub and the rim are first trued, the former with a side tool and the latter with a narrow edged cutting-off tool. Then the face of the pulley is turned, usually with a bevel from edge to center, but sometimes perfectly flat, according to its proposed use. If to be used by a shifting belt it should be perfectly flat, or straight. The pulley face may be finished by filing, and if considered necessary, polished with emery and oil; but on no account should the shaft be filed; its finish should be given by the square nosed tool and water, clear or soapy. The speed for turning is from 24 to 30 feet per minute, according to the quality of the iron. This may be readily understood by calculating the circumference of the shaft or pulley and the number of feet per minute. By a rough calculation a shaft of four inches diameter (twelve inches circumference), to run 24 feet per minute should have a velocity of 24 revolutions in the same time; one of two inches a velocity 96 or 100 revolutions per minute, etc. The feed for a shaft, in turning it, should be from 30 to 50 to the inch; that is, the shaft should revolve 30 or 50 times while the carriage and tool runs over one linear inch. These proportions may be varied according to circumstances, but the best work will be obtained between these proportions.

Balancing pulleys, calculations for machinery to be driven, and hanging shafting will be next considered.

Fastening Beams in Walls---Rat-proof Buildings.

A correspondent, G. W. Tinsley, of Minneapolis, Minn., says that the method of fastening beams in the walls of buildings illustrated on page 165, current volume, has been practiced in Louisville, Ky., for many years, and he thinks it is exacted by an ordinance of that city. He sends also a sketch and description of a method of rendering frame buildings rat proof. The plan is simply to nail to the sill strips of board between each flooring joist, on the inside, reaching to the under side of the flooring planks or board, and thereby covering the shelf formed by the sill between the joists. His idea is to allow the rats no place to stand upon while they are cutting through the floor.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE PATENT OFFICE BEFORE CONGRESS AGAIN.

Mr. Jenckes, from the Committee on Patents in the House, recently endeavored to secure the passage of a bill appropriating $6,000 additional compensation for draftsmen, and $15,000 to enable the Patent Office to lithograph drawings.

Mr. Beck opposed these amendments on the ground that they had not been before the Committee on Appropriations. Mr. Scofield got considerably muddled about the proposition of Mr. Jenckes, and thought the latter gentleman desired to place this money in the hands of the Secretary of the Interior and the Commissioner of Patents, so that they could take it from year to year without coming to Congress and asking for appropriations.

Mr. Jenckes said "No sir!" Whereupon Mr. Scofield desired to have the amendment read by the clerk, and finding that he had got off the track, dropped quietly into his seat and said no more on the subject.

Mr. Dawes, Chairman of the Committee on Appropriations, seemed to understand the matter better, but opposed the measure for the same reasons as were given by Mr. Beck; but Mr. Dawes waxed wrothy, and charged that the Patent Office, though growing in importance every day, had been seriously crippled between thieves on the one hand and inconsiderate legislation on the other, but he was unwilling to vote for Mr. Jenckes' amendments simply because he considered it an irregular way to appropriate money; and furthermore he was unwilling to allow the amendment to be inserted in the deficiency bill in the last hours of a fragmentary session of Congress.

Mr. Ela favored the measure for the purpose of allowing the Patent Office to avail itself of the new process of photo-lithography, by which every examiner, and every other person who may wish, may have copies of the drawings which are annexed to specifications of patents at the very low rate of fifteen or twenty cents each. "I hold in my hand," he said, "copies of some of those drawings by this new process, which cost only about fifty cents, while by the old process of producing copies for presentation to the courts, or for any other purpose, they might cost anywhere from ten to one hundred dollars. I look upon it as one of the most wonderful inventions of the age, and it is of such importance to the Patent Office that I hope this House will not refuse to allow that Office to avail itself of its use. It will not only be a great saving to the Government, but it will also be of the greatest advantage to those who have dealings with the Patent Office. By this process we not only get perfect copies of these drawings, but they may be enlarged or decreased in size as those who need them may require."

Mr. Jenckes tried again to convince the House that his amendment was necessary in order to enable the Patent Office to carry on its work harmoniously and to meet the just demands of inventors, but Mr. Dawes was inexorable though confessing that he did not know what were the necessities of the Patent Office. He seemed to cast some blame upon the Commissioner of Patents for his (Dawes') ignorance, as the Commissioner had been called before the Committee on Appropriations in reference to the estimates for the coming year, "but they got no information from him, and they brought in their bill without the benefit of his experience or knowledge of the wants of that department."

Mr. Jenckes, in his anxiety to get the measure through, asserted that "the Patent Office must necessarily break down after the first of July next, unless some such legislation as he proposed was carried into effect. The announcement of such a calamity had no effect upon Mr. Beck. He was unwilling to throw open the flood-gates and permit the Commissioner of Patents to expend money when he chooses.

In connection with the discussion, Mr. Jenckes is officially reported to have stated that the receipts of the Patent Office this year will exceed the expenditures by more than $1,000,000, which seems to us almost incredible, as the monthly receipts since January have not averaged quite $60,000.

In spite of Mr. Jenckes' persevering efforts, however, the amendment was lost, and we must now look forward to the fulfillment of his gloomy prophecy. We trust, however, that the Commissioner of Patents, upon whose shoulders appears to rest the responsibility, will take some active measures to avert the calamity.

And here we should like to inquire what is the matter with the representatives of the thriving little State of Rhode Island? Senator Sprague has recently uttered some dismal forebodings of evil to the country; and now Representative Jenckes predicts an utter break down of one of the most useful departments of the Government unless a few more thousands of dollars are appropriated towards its expenditures. We can assure our readers, however, that they need not fear any such calamity. The business of the Patent Office will go on, and as usual. The alarm sounded by Mr. Jenckes, however, will do no harm. It may serve to wake up the officials to a keener sense of their duties.

THE HEATING OF BUILDINGS.

Nearly as much bosh is said and written on the subject of heating buildings as upon the subject of ventilation. In fact, the subjects are so intimately related, that it is almost impossible to consider them separately. We believe that the whole subject has been too elaborately treated by those who, in aiming to be ultra scientific, have failed to be practical.

There are four classes of heating apparatus which have had more or less favor, and some of which have been very generally used, viz.: Open fires in grates or fire places, inclosed fires (including the whole generation of coal, wood, and gas stoves), steam heaters, and hot air furnaces.

Of all the devices which the evil genius of invention ever put into the head of man to destroy health and comfort, we believe hot air heaters to be the very worst. Nothing but the utmost care, joined to the best constitution, can prevent an army of ills from subduing the health of those exposed to the influences of these agents of destruction. We speak from knowledge, having had a large experience in their workings, and the opinions we here express, are based upon sound science. It is almost impossible (the experience of those who have had the management of hot-air furnaces will bear us out in this), to so adjust them that an equable temperature can be maintained in any large building. They are most sensitive to external winds, which, as all acquainted with the subject know, influence, to a great extent, the supply of air from without. Even if vaned hoods be placed over the external openings, which admit the vital fluid, it will at once be seen that the varying strength of a wind, blowing from any direction, will render the supply fitful.

But this is not the only, nor the worst evil, attending the use of hot-air furnaces. Recent researches have established, beyond a doubt, that external warmth should be received by radiation; and that any method of warming the body by contact of its surface with a heated fluid is defective and sure to be attended by evil consequences.

Leeds, in his lecture on ventilation, says: "Convected heat is the great curse of the American people. It is that dry, lifeless, withering, debilitating, poisoned stuff with which most of our best houses and public buildings, and, most unfortunately, many of our school houses, too, are filled and warmed, and which is filling our systems, and warming and drying all the life and substance out of about two-thirds of the people of this country."

The same lecturer points out that the lower the temperature of the air we inhale, the more readily and copiously the lungs eliminate carbonic acid, and the languor and depression we feel, on a hot summer day, is attributed to this cause. In the hot-air system of warming, the surface of the body cannot be kept comfortable unless the air be maintained at a temperature much higher than necessary when radiant heat is used.

Professor Silliman has also pointed out that the combustion of organic matter which the air contains, partially unfits it for breathing, which adds to the category of charges against this most irrational way of heating rooms.

Bad as the system is, gas stoves are worse; at least such as provide no escape for the gases of combustion. They may, perhaps, be admissible in summer for culinary purposes, when doors and windows are opened wide, but we should as soon think of sleeping in an apartment connected by an open pipe with the nearest sewer, as in a close room warmed by a gas-stove.

There remain stoves, and steam apparatus, and grates or fire places, to which, in the order named, we prefix the adjectives good, better, best. A great hue and cry have been raised over the effects of stoves upon health. While we admit they have faults of both a positive and negative character, we believe these faults have been much over-rated. It must be confessed, however, that cast-iron stoves are open to the charge of not fully imprisoning the poisonous gases of combustion, while in other respects, they leave much to be desired. It is doubtful, however, whether anything will be devised that, for all classes of people, in all conditions of life, could take the place of the cast-iron stove.

Steam heaters, although not so good as open grates or fire places, come so near perfection, when properly constructed, that, when the consideration of their adaptability to heating large buildings is taken into account, they may be said to be the best of all the means yet invented for general heating purposes. They are deservedly popular, but the highest ideal of comfort, health, and cheerfulness in a heating apparatus seems to us inseparable from the open fire, with its cheerful glow, and its outward draft, which sucks in and devours all poisonous exhalations. It makes dust in a room, and this provokes good housekeepers to wrath, but, upon our own temper, we have found its effects to be most bland.

AN IMPORTANT OFFICE TO FILL.

TO PRESIDENT GRANT:—

You have doubtless been reminded, ere this, that there now exists a $3,000 vacancy in the Board of Examiners-in-Chief of the Patent Office, and it is very likely that several worthy gentlemen have been suggested to you as proper persons to fill that vacancy.

We desire the place neither for ourselves nor for any relative or friend. We have never thought it desirable to urge the claims of personal friends for Patent Office appointments. But representing about one-third of the whole clientage of that Office, we claim a right to say something to you about the selection of a proper person to fill this important position. In the first place the interests of anxiously waiting appellants require that the vacancy should be filled with the least possible delay. The cases on appeal are rapidly increasing, the interests of inventors are suffering, and it is of paramount importance that this work should be immediately and energetically reinforced. In the second place, and in view of the present composition of the Appeal Board, it is vastly important that the place should be filled by an active, vigorous expert, one who can grapple energetically with the many cases that now press the Board for Examination.

There are such men in the Patent Office—they are to be found among the younger and more active employés. We beseech you to give us a man of energy, and to avoid filling the place by the appointment of some venerable gentleman who might better be placed on the retired list. The Patent Office is increasing in importance; its duties are now indifferently performed; there is already felt a lack of energy in the management of its complex details, therefore it behooves you to select an energetic man, one who can make himself felt in the discharge of his duties.

Very Respectfully, Yours,

MUNN & CO.

PERSONS UNFITTED FOR THE COMMISSIONERSHIP.

There are, as usual, numerous applicants for the office of Commissioner of Patents, and all, or nearly all, are Solicitors of Patents. The attorneys for several of the mowing machines are especially prominent; the sewing machine patentees have their favorites, while india-rubber is content with the present state of things. Now, all these gentlemen may be worthy and competent; but we submit that they cannot be the proper persons to pass upon such questions as come constantly before the Commissioner of Patents. It is safe to say that there are no patent lawyers who are not pecuniarily interested in inventions, and a mere assignment of all such recorded interests would scarcely satisfy the public which sustains this important bureau of the Government. Aside from this, inventors would scarcely believe that a solicitor, who had for years been supported by the owners of a patented monopoly, would at once conquer the prejudices with which the earnest advocate is so apt to become imbued. The head of this department acts as a judge in suits of vast importance, and should be selected with a view to his judicial experience and acumen, as well as his executive ability; and not because of any part which he may have enacted in questions of priority and infringement.

We fully indorse the above from the New York *Times* of April 9th. A Commissioner of Patents should neither be a patentee, solicitor, or patent lawyer, but a man of good executive ability, and possessed of sufficient legal experience to weigh evidence and decide promptly in all cases that come before him. To this add honesty and energy, and you have all the requisites for a good Commissioner.

THE PACIFIC RAILWAY IMBROGLIO.

For some time past rumors have been hurtling in the air that the Pacific Railway would soon develop one of those great swindles which occasionally startle the community. A very curious lawsuit now going on in this city, between James Fisk, Jr., on the aggressive side, and the Union Pacific Railroad on the defensive, is operating to reveal some curious facts concerning an intermediate agency called the "Credit Mobilier," named after a similar financial vehicle in Paris, which went to smash about a year since. In the progress of the suit it was deemed important to get access to certain books of the "Credit Mobilier," but the key of the safe could not be found—some one holding it had gone to New Jersey, and it was uncertain when he would return. Here was a dilemma, which Justice Barnard, of the Supreme Court, solved at once by ordering a receiver to open the safe. This functionary, in company with several ingenious iron-workers, broke open the safe, got the books out, and bore them in triumph into the presence of the learned judge. With the aid of these, it is expected that some important revelations will be brought to light; but we apprehend that the real meaning of this seemingly inexplicable litigation will show itself as the plot unfolds, and respecting which we are beginning to get our first knowledge from certain proceedings in the Senate instituted ostensibly to protect the rights of stockholders. Senator Stewart, of Nevada, in some remarks on the subject, said it was alleged that the "Credit Mobilier" had made enormous dividends by using the Pacific Railroad. This the members of the "Credit Mobilier" admitted. The senator also said that they were encumbering the road with contracts ahead for their own benefit. Other senators, who pretended to know something about the Union Pacific Company, had said that the company was liable to become insolvent any day, and if that should come to pass, the result would be that the first mortgage bonds would be foreclosed, and the Government lien would be cut off, and this Congress would be held responsible for it.

The importance of Senator Stewart's foreshadowing is made apparent by the fact that the Government has already issued $56,852,320 in bonds to the Pacific Railroad, upon which the company assumes to pay the interest; but if the first mortgage is suffered to be foreclosed, of course the people must be taxed to pay the interest on the whole of the above issue of bonds.

SPRINGS, THEIR POWER AND USES.

The peculiar property possessed by various materials, which has received the general name of elasticity, exhibits itself in many ways. Some substances manifest it, when compressed, in a high degree, while bars of the same material may be bent without developing elastic power to any great extent. Others on the contrary, exhibit great elastic power when bent, and comparatively little upon compression. Others, again, may be stretched without manifesting much elasticity, while upon bending they show it in a high degree.

Springs may be classed as follows: Flat, straight, or bar springs, coiled springs, spiral springs, and block springs, intended to resist compression, usually made of rubber, and in common use on railroad cars, etc., convex disks, concave disks, or a union of the two latter in a corrugated spring.

In metallic springs it is found that the elastic power resides in great measure near the surface. A well-tempered bar spring will lose much of its elastic strength by filing off a very thin scale from its surface. This fact has never yet been explained satisfactorily.

Power may be applied to springs in four ways. They may be stretched, compressed, bent, or twisted. The elasticities developed in the same material by these different methods of application, are not demonstrated to possess any ratio to each other. In fact, the mathematical data relating to springs are extremely meager, and it is greatly to be desired that some accurate experimenter would give to the world some tabulated results that could be relied upon with certainty as a guide in construction. At the present time there is nothing of this kind, so far as we know, that can be referred to.

It is evident from the fact above stated—namely, that the elastic power of springs lies, in a great part, near or upon their surfaces—that the form of the metal which presents the greatest surface will give the maximum power, within certain undetermined limits. The doubling of the thickness, the width remaining constant, will not give double power, while doubling the width will nearly double the elastic power if the thickness be the same.

But while the elastic force is found to be in some way dependent upon the surface, it is also evident that there must be some ratio which the thickness should possess in regard to the other proportions, in order that the maximum effects should be maintained. It is easy to see that were the leaves of an ordinary elliptical carriage spring much reduced in thickness their strength would be impaired.

At present the determination of the strength of springs is left almost wholly to experiment. It is plain also, that whatever data may be determined for springs having proportional dimensions, and considered as being formed of homogeneous material, and of the same temper, nothing but experiment could determine their strength with accuracy, for, although dimensions may be accurately determined, the quality of the metal and exactness of temper can never be relied upon as constant. Approximate results, however, might be obtained of great use in the construction of this important element of machinery.

The uses of springs seem constantly multiplying. A large number of most important machines, such as printing presses, and the like, employ them in almost all their forms. In many clocks, and all watches, they are the prime movers, while their employment for all sorts of vehicles need not be more than alluded to.

A class of rather visionary inventors have vainly (as yet) endeavored to use them as the propelling power for vehicles, and we receive many communications requesting our views upon the feasibility of so doing. While there is theoretically no impossibility, in the idea of such propulsion, we think we can see so many practical difficulties in the way of its accomplishment as to render its success extremely doubtful. These practical difficulties are so well known that they need not here be specified. Mechanical skill may possibly eventually overcome them, but let not the mistake be made that a spring possesses any more power than is delegated to it. It is only a magazine of power, and can give only what it has previously received. We should have considered this last remark unnecessary had it not been that the tone of some communications lately received indicates that their authors have not fully purged themselves of the old illusion of the perpetual motion.

PROTOPLASM.

Protoplasm is the scientific name for a substance which modern science has demonstrated to be common to all living things from the lowest plant to the highest animal organization. Prof. Huxley demonstrates that it may in itself exhibit all the phenomena of life. It contains oxygen, hydrogen, nitrogen, and carbon. Before these elements can form living protoplasm, they must unite to form the binary compounds known as water, carbonic acid, and ammonia. In the presence of pre-existing living protoplasm these compounds form a complex living substance, new protoplasm, which, Prof. Huxley so aptly terms the "physical basis of life." He says: "To this complex combination, the nature of which has never been determined with exactness, the name of *protein* has been applied. And if we use this term with such caution as may properly arise out of our comparative ignorance of the things for which it stands, it may be truly said that all protoplasm is proteinaceous, or, as the white or albumen of an egg is one of the commonest examples of a nearly pure proteine matter, we may say that all living matter is more or less albuminoid."

The living protoplasm of animals, a good example of which is seen in the white corpuscles of the blood, has not the power to influence the combination of the above-named compounds into new protoplasm. This power belongs only, so far as is at present known, to vegetable protoplasm, which, however, is not on that account to be considered as distinct from animal protoplasm. The latter has the power of converting dead animal or vegetable protoplasm into living animal protoplasm.

In this view protoplasm is the primary "matter of life," the first step from the inorganic into the organic world.

SKINNING AND STUFFING BIRDS.

The preservation of the skins of animals and stuffing them so as to preserve their natural appearance, is an art requiring considerable skill and taste. It is also of great utility in the study of natural history, as well as a very pleasing pursuit for amateur collectors.

We are requested by several correspondents to give some information upon the skinning and stuffing of birds. While no amount of verbal instruction can give practical skill and artistic taste in the preparation and mounting of specimens, what we may say will perhaps be useful as a guide to those who have just begun to exercise this instructive and amusing art.

It is more difficult to properly prepare and mount bird skins than those of other animals, as the preservation of the plumage in an unruffled and unsoiled state, is the point to be aimed at, and feathers, if broken, are very hard to re-adjust properly.

In killing birds with shot the feathers are very apt to be more or less damaged and soiled with blood, which, if it be permitted to dry on the plumage, will be difficult to remove without some permanent disorder in its arrangement. These evils may be in a great measure avoided if the sportsman will attend to the following directions: He should take the field provided with a small box of cotton wool, a bottle of water, and a small shallow dish of some kind to hold a small portion of water at need. He should also be equipped with some small sable brushes, such as are used in water color painting, and a short piece of stiff wire with the end rounded. As soon as he has shot a bird he should aim to get it in hand as soon as possible, and plug the shot holes with cotton to prevent further bleeding. In doing this he will find the wire above alluded to a very useful instrument. When the bleeding is stopped, he should next cleanse the feathers from the blood which has already flown, by using the water which he carries for the purpose and the brushes. If the blood is thus removed before it dries, it can be so completely washed off as to leave no stain even on the whitest feathers, and at the same time their texture may be preserved from damage. Should any of the feathers become so much bent as to be difficult to straighten, they may be restored measurably by soaking in hot water.

Before skinning, the principal dimensions of the bird should be taken and noted down for reference in mounting. The first incision should be made longitudinally backward from the lower point of the breastbone. From the beginning of the operation to the conclusion, all fluids should be constantly absorbed by cotton wool, the greatest care being taken that they do not flow out and soil the feathers. As fast as the skin is separated from the body a thin layer of cotton should be inserted to prevent its adhering to the flesh and for purposes of absorption. Through the incision made as directed the entire process of skinning must in general be performed. When the skin is stripped down from the muscular portions of the legs, they must be cut off on the inside of the skin with scissors or a knife so as to leave the feet attached to the skin. The tail is likewise cut off on the inside at its attachment to the back. The body can then be suspended from a hook and the skinning proceed toward the head by turning the skin inside out. When the wings are reached the skin should, if possible, be removed as far as the joint constituting the elbow, but if it is found difficult to do this without tearing the skin, the bone may be severed as low down as practicable, by use of cutting pliers or strong scissors. Great care will be needed to avoid breaking the delicate membrane which constitutes the external ear upon the heads of birds which are nearly or quite bald. Care is also required in manipulating the eyes, the external membrane of which ought, if possible, to remain unbroken. The brain is removed from the skull through incisions made well back through the roof of the mouth. All loose flesh and fat about the neck, tail, and legs, should be removed from the skin. For this purpose the skin on the wings may be cut through on the inside, when it covers those parts from which the bone and flesh could not be removed. The parts liable to decompose may then be rubbed over on the inside with arsenic, or arsenical soap, which will effectually prevent decay.

The skin is now ready to be stuffed, which although it seems simple in description, requires considerable skill. If glass is not used for the eyes their orbits should first be stuffed through the mouth with cotton. Next the upper parts of the throat should be filled with the same material. A roll of cotton should now be inserted through the first incision, and pushed up through the neck to the base of the skull. Then the body should be filled, during which process the wires for supporting the bird when mounted should be inserted into the legs, neck, and wings. This completes the process so far as it can be described in words, with the exception of sewing up the opening through which the stuffing has been performed. This requires no special skill to be performed neatly.

Some slight variations in the method are requisite, according to the character of the bird. For instance, a very large bird may require to have the neck cut off when the skull is reached, and the skinning of the head to be performed by an incision from the outside down the back of the skull.

In mounting birds there is room for considerable display of taste in the adjuncts. A branch of the tree which the bird most affects, with artificial leaves, may be used with good effect as a support for the feet. The natural beauty of the plumage may be enhanced by suitable contrasts of color in the lining of the case where they are kept. An aquatic bird may be shown holding a fish in its mouth, such as it commonly obtains for its food, and many other fancies will suggest themselves to those who wish to excel in the art.

The directions we have given will, if observed, enable any ingenious person after a little practice to skin, stuff, and mount a bird creditably.

WHY DON'T BOYS LEARN TRADES?—MECHANICAL LABOR.

Our recent agitation of this question and subject has brought us a number of communications. We do not propose to iterate and reiterate our statements or suggestions. We have already stated the facts, and pointed out the possible and practicable remedy. It is perfectly simple, and entirely feasible. But we give the gist of a few of the communications we have already received, in order to show the general feeling on the subject, and in the hope that those in whose hands the remedy lies may be induced to apply it. A young man, signing himself "Eugene Dunbar, of Holliston, Mass.," says: "There are many boys, myself included, who would be very glad to learn some good trade. For several years I have been very desirous to learn the trade of a locomotive machinist, but, although not too proud to take an apprentice's position, I have not met with success in my endeavors to obtain a chance to learn the business."

Another writing from Georgetown, D. C., referring to our article published on page 169, current volume, under the heading, "Why is Mechanical Labor Objectionable?" says: "Education is everything. But just so long as we train our young people in literature and the classics, we must necessarily breed a race of men and women lazy in the qualities demanded by mechanical labor. Our school system needs a thorough remodeling. Our farmers' sons, after passing through a course of literary training lose all taste for the noble art of cultivating the soil. We should have a more healthy state of society, if, at school or college, our children were thoroughly instructed in a practical knowledge of mechanics and agriculture. The cultivation of the soil demands for its intelligent management a knowledge of chemistry, botany, geology, of fruits, trees, rearing of cattle, of the properties and uses of manures, etc., all of which afford pleasure, and give healthy mental and physical occupation. He who is once initiated into this science of sciences, and its application, will not quit the cultivation of the soil for any meaner profession. Literary training, instead of being the principal object of school education, should be considered a recreation, and the practical should take precedence."

E. W. Dean, of Norwich Town, Conn., also writes that he has passed through the ordeal, having been a clerk three years, where his hands were kept soft and white, and then became a machinist's apprentice. This was hard on his hands, and insured his receiving the cold shoulder from his acquaintances, who before welcomed him. He, however (very wisely, in our opinion), prefers his position of independence as the master of a useful art than as a mere caterer to the tastes of purchasers of finery.

The following from the Philadelphia *Morning Post* is allied to the general subject, and we therefore copy it: "The late report of the directors of Girard College shows not only the great changes that have in late years taken place in our social and business systems, but a very unpleasant result in regard to the college. There are now forty boys in the institution who are ready to go out, but who are obliged to remain because there is no one willing to receive them under indentures, as provided by the will of Girard. The system of indentured apprenticeship having fallen into discredit and disuse, these boys are unable to find masters, and must, therefore, remain in the college, occupying the places of many who are ready to enter, thus interfering very much with the usefulness of the institution. There is, it appears, no legal way of disposing of these pupils, who have gone through the prescribed course, and have drawn from the college all the benefits to which they are entitled.

"According to the will by which the institution was founded and governed, these boys must be bound out to learn a suitable trade. That patiently waiting for persons willing to take them under these conditions will be of any avail we doubt. Every month, every year will find fewer and fewer business men adhering to the old system of apprenticeship. Every year the number of boys who have graduated but cannot leave the college, will increase, until in time the whole establishment will be filled with its alumni, to the total exclusion of new scholars, and this body of graduates must, we suppose, stay there until they are old men, and every time an octogenarian drops off, a boy may be admitted.

the legislature is empowered to pass such a law as may enable the Board of Directors to place the boys at suitable trades and callings without the necessary accompaniment of an indenture, it should immediately be done."

VELOCIPEDE NOTES.

One of the most brilliant exhibitions of skill in velocipedestrianism that has ever taken place in this city or elsewhere, took place at Apollo Hall, corner of Twenty-eighth street and Broadway, a few evenings since, under the direction of the Pearsall Brothers. Dodworth's band was present, and the evolutions of the skillful riders present on the occasion were rendered more pleasing by the accompaniment of splendid music, for which this celebrated band is distinguished. The tournament opened by the entrance upon the floor of twenty-five of the most expert riders in the country, whose advent called forth immense applause, renewed as the graceful evolutions of the performers excited and delighted the admiring assembly. The affair was very select, and was attended by a large and fashionable concourse of ladies and gentleman.

Nearly all the bicycles in popular favor were represented, but the most attractive feature of the evening was the performance of a sister of Messrs. Pearsall, on a beautiful little ladies' velocipede, which has been appropriately called the "Peerless." This machine has low wheels, and is propelled by treadles connected with the cranks, so that a special dress is not required by the fair rider. It is altogether a most attractive design, and will, we think, speedily become a favorite with the fair sex.

A two hundreddollar Pickering velocipede is offered by the Pearsalls, to be competed for the fastest time in a half mile at the Gymnacyclidium, on Thursday, the 15th inst. The machine is mounted with silver plate and ivory fittings, and is a gem.

A challenge has been put forth by Mr. Frederick Hanlon, who offers to race any velocipedist of the United States for a thousand dollars a side and the championship. The race to take place in this city or Brooklyn, half mile heats, best two out of three. The time between the heats to be ten minutes. The party accepting the challenge to choose his own velocipede, the fore wheel of which shall not exceed 37 in., except it be a Demarest, in which case the fore-wheel shall not exceed 41 inches.

The *Herald* says: "It is probable that a Brooklyn expert will accept Mr. Hanlon's $1,000 challenge, and that the race will be arranged to come off at the Empire City Rink."

Mr. Stephen W. Smith has commenced a suit against Mr. Calvin Witty for alleged infringement upon patents originally granted to Philip W. McKenzie, of Jersey City, and subsequently assigned to Mr. Smith. The McKenzie invention was illustrated in these columns a few weeks ago.

Much diversity in opinion, as to the proper dimensions of the velocipede wheels and cranks, has existed, but the favorite size seems to be from 30 to 36 inches for diameter of driving wheel, and 6 inches for length of cranks. We have seen larger ones, but we doubt that they will be much used so long as the bicycular form of velocipede is considered the best.

Since writing the paragraph in regard to rubber tires for velocipedes, we have had submitted to us a number of plans for fastening them. To fasten them firmly has been the difficulty heretofore. Some of the plans proposed seem well adapted to meet the requirements of the case, but actual trial can alone demonstrate their value.

We saw recently a bicycle propelled up the heavy grade from the Wall Street Ferry to the top of the Brooklyn Hights. We were too far away to ascertain the maker of the machine, or the name of the rider. When we add that this grade is certainly not less than one foot in ten, our readers will appreciate the significance of this statement, with reference to the possibility of overcoming steep grades. The rider ascended the entire grade, certainly not much less than three hundred yards in length, using the flagged sidewalk as a way.

The *Brooklyn Union* says, the fastest time yet made on a velocipede in this country, was that made by Messrs. Burroughs and Demarest, on the night of the third inst., on Demarest machines, with 45-inch and 41-inch driving wheels. The trials took place on the mammoth rink in Third avenue, and the machines which were ridden were the Demarest, Wood, Pickering, Mercer, and Monod, and the Union Hardware Company. Previous to the race the Tilton Brothers and the two Tildens did some bicycle gymnastics, and the display was much admired. We heard a suggestion made that the exhibition would be preferable if the two parties went in couples rather than in a quartette. After the fancy riding came the races. The course was half a mile, three times the circuit of the hall, the center of the hall being marked off by rows of seats for exercise riding. Mr. Burroughs led off on a 45-inch Demarest, and he went round at a startling pace, making his first circuit in eighteen seconds, great time for the sixth of a mile. He, however, started too fast to keep up his pace, and he occupied 72½ seconds in doing the entire distance. Darling was the next, and he made the half mile in 71¼ seconds on a 41-inch Demarest. Young Hamburgh now tried in on a a 33-inch Union Company machine, and he made excellent time, coming-in in 85½ seconds. Mr. C. D. Demarest now got on a 41-inch Demarest machine, and he flew round the hall at a rapid pace, coming-in in 68½ seconds!—the fastest half-mile time on record. A Mr. Weed then tried a 38-inch Pickering, but it took him 90 seconds to go the half mile. G. Tilden then tried his skill on a 45-inch Wood machine, and he did his half mile in 76½ seconds, his brother doing it in 83½. A rider named Capeless was the last, and he went round on a 35-inch Monod in 84 seconds, and thus ended the trials.

Editorial Summary.

The State Engineer of New York has transmitted to the Legislature his report for the year ending September 30, 1868. This document furnishes the aggregate statistics of 157 companies, as follows: Total cost and equipment of steam roads, $208,185,783; horse roads, $21,133,522. Passengers carried by steam roads, 18,434,300; tuns of freight carried, 11,961,632. Number of passengers carried in city cars, 146,326,486. Cost of maintaining steam roadway, $13,074,595. Cost of operating roads, $15,250,716. Earnings, steam roads, $49,377,790; horse roads, $8,262,291. Persons killed on steam roads, 302; injured, 358. On horse roads, killed, 13; injured, 90. During the year ending September 30, 1868, under both the general railroads law and special acts, thirty-six companies, with a total capital stock of $23,125,000 and a total length of 750 miles, have organized and filed their articles of association in the Secretary of the State's office. During the same year, 169 miles of railroad, under twelve companies, have been opened.

BUSINESS OF THE WORLD'S RAILWAYS.—*Van Nostrand's Engineering Magazine*, says that according to the calculations made by the Government Statistical Office at Berlin, the number of passengers conveyed daily by the railways of the world amounts to three millions, and the quantity of goods to twenty-seven millions of centners, or a million and a half of tuns. Also 58,000 telegrams are forwarded, and four millions of letters delivered every day. The daily gross receipts of the railways are 8,000,000 florins; they possess 40,000 locomotives, 1,200,000 carriages and vans, and give regular employment to a million persons. The aggregate length of the telegraph wires would, if united, reach to the moon and back again.

THE great Polish salt mine, recently noticed as in danger of being destroyed by the inundation of water, is pronounced safe by the committee of seven of the principal engineers sent to institute an inquiry on the subject. These functionaries have now sent in a report to the effect that the irruption of water is not of a nature to destroy the mines or prevent their working; and that the forcing pumps for emptying the pit are now nearly all set up.

COAL OIL BURNERS.—We are receiving inquiries in regard to the report of the committee appointed by the American Institute to test coal oil burners, sent to them for that purpose, in pursuance of a notice published sometime since in the SCIENTIFIC AMERICAN. The report will undoubtedly be made in due season, when we will give our readers the benefit of the results obtained.

NEVER HEARD OF IT.—A rustic gentlemen called at a wholesale store the other day, and after purchasing a bill of goods, was asked by the junior proprietor if he had "ever seen a velocipede," "Is that the machine that adds up three columns of figures at once?" said rustic. The reply was in the negative, and he was piloted round to a velocipede school and introduced to the mysteries.

A COTEMPORARY says that two gentlemen in Meriden, Conn., have completed the invention of a needle manufacturing machine. This machine takes in the wire and turns out a completely finished needle—except pointing, hardening, and tempering!

SOLUBILITY OF INDIGO.—M. Camille Kœchlin has discovered the curious fact of the solubility of indigo in alkaloid, salts, and particularly in the acetates and chlorides of aniline, morphine, etc.

VELOCIPEDE PATENTS.

In the United States Circuit Court, April 5th, the suit of W. Smith agt. Calvin Witty was heard. The plaintiff charged that the defendant had infringed on his patents for improvements in velocipedes, and prayed that an injunction be granted. He averred that Philip W. McKenzie, of Jersey City, had obtained at various times three patents for improvements in velocipedes, and had sold the same to him; that he (Smith) had, at great trouble and expense, been manufacturing, for sale, velocipedes made under said patents, and that he will realize large gains therefrom if infringements are prevented; that various parties in different parts of the United States have acknowledged the validity of his (Smith's) claim to said patents, and have taken license thereunder, but that Witty has continually, in violation of his (Smith's) rights, made and sold velocipedes containing the improvements patented as above stated, and that he is still doing so. Smith further says that despite due notice on his part, Witty has refused to desist from infringing these patents. He therefore prays that Witty may be enjoined from continuing these alleged infringements; that he may be compelled to pay him (Smith) the profits he has acquired and the damages he (Smith) has sustained by such alleged infringements, and that Witty be compelled to make a discovery of how many velocipedes, infringing, as alleged, his (Smith's) patents he has made, and how many he has sold. A motion for Witty to show cause why the [illegible] asked should not be obtained is to be argued.

The McKenzie patent, under which Smith claims, is illustrated on page 181, and the patent of Lallement, owned by Witty, on page 102, present volume, SCIENTIFIC AMERICAN.

NEW PUBLICATIONS.

GEOLOGY OF NEW JERSEY, 899 pages large octavo, illustrated by 108 Photolithographic Engravings and Woodcuts, and six Mine Maps; and accompanied by a portfolio containing Maps in sheets of

1. Azoic and Paleozoic Formations, including the Iron ore and Limestone districts; colored. Scale, 2 miles to an inch. 2. Triassic Formation, including the Red Sandstone and Trap-rocks of Central New Jersey; colored. 3. Cretaceous Formation, including the Greensand Marl Beds; colored. Scale, 2 miles to an inch. 4. Tertiary and Recent Formations of Southern New Jersey; colored. Scale, 2 miles to an inch. 5. Map of a Group of Iron Mines in Morris County; printed in two colors. Scale, 3 inches to 1 mile. 6. Map of the Ringwood Iron Mines; printed in two colors. Scale, 8 inches to 1 mile. 7. Map of the Oxford Furnace Iron-ore veins; colored. Scale, 8 inches to 1 mile. 8. Map of the Zinc Mines, Sussex County; colored. Scale, 8 inches to 1 mile. Price of the book and portfolio of maps, $5·00. Same, without portfolio of maps, but containing a folded and colored map of the State, on a scale of 5 miles to 1 inch, $4·00. Single copies of either of the above maps, colored and in sheets, 50 cents. The prices are fixed to merely cover the cost of paper, printing, and binding; the expenses of the survey and preparing book and engravings being paid by the State. These publications can be had from Prof. George H. Cook, State Geologist, New Brunswick, N. J., on remitting the price, or through the booksellers. A valuable book, from which we can promise our readers some interesting extracts, as soon as space will permit their appearance.

FORCE AND NATURE, ATTRACTION AND REPULSION; THE RADICAL PRINCIPLES OF ENERGY, DISCUSSED IN THEIR RELATIONS TO PHYSICAL AND MORPHOLOGICAL DEVELOPMENTS. By Charles Frederick Winslow, M. D. Philadelphia: J. B. Lippincott & Co.

We have endeavored, before expressing our views in regard to this book to read it in a perfectly candid spirit of inquiry. We confess that we found it hard to maintain that spirit to the end. Its style is at times forcible, and its author has evidently caught more than a mere glimpse of certain fundamental truths; but while saying this much, we are compelled to add that it is one of the most illogical books we ever attempted to peruse. It is full of fantastic speculations, and contains not a few errors in its statements of facts. It is wearisome, from its interminable repetitions, and its diffuse method of discussion will hardly fail to draw upon it the severe criticism of thinking readers. In short, it is to philosophy what punch is to the palate, full of incongruities; and, although too much diluted by redundant forms of expression, still quite palatable, but not very nutritious. Claiming at the outset to assume nothing, it ends by assuming everything. Written to enunciate what is evidently a pet theory of the author, namely, that repulsion is equal in quantity to attraction, and that the two are coexistent, and the foundation of all material existence, it will convince few, while its speculations will, if we mistake not, draw upon its author a storm of adverse criticism.

THE AMERICAN YEAR BOOK AND NATIONAL REGISTER FOR 1869. Edited by David N. Camp. Hartford: Published by O. D. Case & Co.

This work is, as its preface informs us, the initial volume of a proposed annual publication, prepared to meet an increasing demand for information respecting the affairs of the General and State Governments, public institutions, finances, resources, and trade of this country; the political, financial, and social conditions of other countries; and various other subjects relating to social and political economy. The work is a thick 8vo, printed and bound in excellent style; and, so far as we can judge from a hasty review of the large mass of statistical information it contains, seems a valuable work of reference.

WE have received from the publishers in Berlin, Messrs. A. Effert and Lindtner, a copy of the "Verhandhungen des Vereins zur Beförderung des Gewerbfleisses in Preussen (Transactions of the Society for the Advancement of Useful Arts in Prussia), for 1867; being the sixty-fourth year of the existence of the society. The members of this society include not only the King of Prussia, and other royal personages, but also the most scientific men of the kingdom. It also comprises a large number of scientific and industrial associations. These facts a are sufficient warrant for the value and interest of its contents. The present number for January, February March, and April, 1868, contains the business transactions of the society, list of members, minutes of meetings, list of premiums offered for valuable inventions, followed by articles illustrated with profuse and finely-executed engravings, upon the following subjects: "On the Production of a Green Coating on Bronze;" "On Stamping Presses;" "On Kapselräder," in which category are included rotary pumps, wheels, etc., "On the Resisting Power and Elasticity of Wrought Iron Double T-Beams;" "On Boiler Explosions in Prussia during the Year 1867." It also gives a list of new patents granted in Prussia during 1867; and a table of prices of wool in all the market towns of the kingdom during the year.

"THE LITTLE PEAT CUTTERS; or the Song of Love," is the attractive title of a new volume of the Sunday school series of choice religious works published by Henry Hoyt, Boston. "Kate and Her Brother," also published by the same firm, will prove an interesting story for the little ones. For sale in New York by N. Tiballs & Co., 37 Park Row.

WE have received parts 13 and 14 of "Locomotive Engineering," edited by Zerah Colburn, and for sale by John Wiley, 535 Broadway, New York. They fully maintain the character of the previous numbers received, and are unsurpassed in beauty of illustration and typographical execution.

PART VI. of "Packard's Guide to the Study of Insects" is also at hand, profusely illustrated, and full of entertaining and instructive matter.

"Van Nostrand's Eclectic Engineering Magazine" makes its appearance for April, with a well-selected array of engineering and mechanical essays, and items.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

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

☞ *All reference to back numbers should be by volume and page.*

G. J., of Me., says, "a combined steel and iron rail of excellent quality is manufactured in Portland, Me." This in commenting on an article in the SCIENTIFIC AMERICAN published on page 213 current volume copied from the London *Engineer*. We do not hold ourselves responsible for statements made by other journals and copied into our columns.

C. M. B., of Conn.—We propose in our series of articles on "Shafting Pulleys and Belts," now in course of publication, to give some directions in relation to pulleys and belts, relative diameters, etc., which will better meet your case than any reply we can make in this column.

P. J. P., of Mass.—To turn a true taper on the lathe, the cutting point of the tool should be exactly at the center of the piece which is to be turned. In ordinary turning it is better to keep the point above the center.

J. H. W., of Pa.—The reason why your cold chisels break is to be found in your hammering them when nearly cold, to "smooth finish" them, as you say. It is certain that this extra finish produced by hammering refines the steel—compacts its fibers—and thus changes its texture, and consequently its before ascertained quality. It will not stand so high a temper. All the hammering required is that necessary to bring the chisel into shape while hot, changing the texture of the metal as little as may be.

H. O. B. of Mich.—You are mistaken in supposing that a very great distance is necessary between shafts connected by a quarter turned belt. We have seen them run at only three diameters apart; that is, two six-inch pulleys only six inches between their perimeters, the centers of the shafts only twelve inches apart. Width of belt is an obstacle in the way of extending the principles of running turned or twist belts. In our answer to "W. H. of Pa.", on page 251, the "15 feet" should have been 30 feet. This matter of belts will receive further attention in a subsequent article, one of a series on "Shafting, Pulleys, and Belts" now being published in these columns.

H. McD. of N. Y., will see his critical note embodied in an article on the same subject to appear soon. His suggestions are worthy the subject and will receive due attention.

J. I. G., of Pa.—You can brown your gun barrel by coating it with oil (sweet oil) and heating it over a fire. We prefer, however, the use of acid as giving a darker and more even color. If the surface is properly cleaned before applying the acid there will be no difficulty in getting an even shade.

B. R., of Iowa says, in relation to prevention of limy incrustations in boilers, mentioned on page 219 current volume, SCIENTIFIC AMERICAN, that the use of oak saplings therein mentioned is really advantageous, as he has used it successfully for twelve years and never knew it to fail. Or put half a bushel of common (Irish) potatoes in the boiler and no more trouble will be experienced. As to patent powders he has never tried them.

E. H., of Mass.—In Shaffner's Telegraph Manual, page 605 and those succeeding, you will see sections of just such cables as you describe, containing more than one insulated conducting wire.

M. and Sons, of Ill., have a boiler 14 feet long, 30 inches diameter with 18 three-inch tubes, which become clogged with "soot" from the bituminous coal. The stack, of plate iron, rises 40 feet. The hight of stack is ample, unless adjacent structures, or natural obstacles, as hills, etc., obstruct the draft. If the boiler is horizontal there is no reason why the flues or tubes cannot be cleaned with a brush or scraper. If upright, the stack might be placed near the boiler, but not directly over it, and the elbow have an opening, or cover, for introducing the brush. But, after all, the truly scientific and correct way to remedy the evil is to consume the soot, which is only unconsumed fuel, and is in this case worse than wasted. We refer our correspondents to No. 9, Vol. XVII, Scientific American, first page, which contains an article on boiler-setting that may be suited to their case.

N. G. P. of Del.—So-called liquid glue is made by dissolving shellac in wood naphtha. A quarter of a pound, apothecaries' weight, of the gum to 3 ounces of naphtha.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per line will be charged.

W. J. T.—We think the patent asbestos roofing manufactured by H. W. Johns, of this city, is the best substitute for tin or slate. It is cheap and easily applied.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

Immense discoveries of gold placers are reported from Alaska. The mines are on the main land, 120 miles from Kodiak Island, in latitude 61 degrees north, and longitude 150 degrees west from Greenwich. Three several discoveries have been made; the first on Kuyack river and Chigmet mountains, the second about 60 miles above Sitka, the third on an ocean island, the name of which is unknown. The mines, on account of the climate, can only be worked five months in the year.

The Fulton Iron Foundery, at Pittsburgh, Pa., are doing some heavy work. Among their recent productions is a fly wheel used in the Union Mills, of that city, which weighs 22½ tuns, and was cast in one piece. At these works chill rolls 30½ inches in diameter and 96 inches in length of body, have recently been made, each casting containing 15½ tuns of metal.

The Yantic thread company of Fall River, Mass., has decided to erect a mill with 5,000 spindles to spin yarn. The Fall River manufacturing company will build on the site of its cotton mill, burned down in May last. The new mill will contain 25,000 spindles and 600 looms, and will weave 6,000,000 yards of prints annually. The old mill had only 9,000 spindles and 185 looms.

A cotton mill with 10,000 spindles is to be started at New Orleans, and a similar one at Savannah, Ga. Within a few weeks $900,000 worth of manufacturing stock has been subscribed for at Columbus, Ga.

The production of beet-root sugar in Europe last year was as follows: 220,000 tuns in France; 165 in Germany; 97,500 in Russia; 92,500 in Austria; 32,500 in Belgium; 15,000 in Poland and Sweden, and 7,500 tuns in Holland.

It is stated that the New Jersey Central Railroad has appointed a number of district surgeons along the line of their road to give prompt attention to sufferers in accidents.

The Pacific Mail Steamship Company, have shipped from Baltimore 3,220 tuns of coal to Japan, 3,892 to San Francisco, and 803 tuns to Hong Kong.

A Western paper says that solid masses of gold underlie the Rocky Mountains. All that is wanted to secure it is an "eligible hole."

The snow shed of the Central Pacific Railroad is the biggest building in the world. It is 16 feet wide, 16 feet high, and 22 miles long, and took about forty million feet of lumber.

The Sault Ste. Marie Canal has been ceded to the United States by the State of Michigan.

Four thousand million pounds of rags are estimated to be made annually into paper in the world.

Our English exchanges are full of brag over their new iron clad, the *Hercules*. They claim that she is the swiftest and most powerful vessel afloat.

A triple barrel gun has been invented in Pittsfield, Mass., two barrels for shot and one for ball.

France during the last year exported two hundred thousand dollars worth of velocipedes.

Glass mold boards for plows to resist corroding soils are said to have been recently invented.

Indiana is said to have eight thousand square miles of iron and coal lands.

Miners are again beginning to work the old and deserted lead mines of Dubuque.

Marbleizing slate is now extensively carried on in the Vermont quarries.

A firm at Bridgeport, Conn., are turning out forty velocipedes weekly.

France has a corps of 266,166 fireman, who manage 12,720 fire engines.

Gold, it is reported, has been found in Bureau county, Illinois.

Recent American and Foreign Patents.

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

Potato Digger.—Ira Curtis, Des Moines, Iowa.—The object of this invention is to provide for public use, a simple, cheap, and effective machine, which will dig the tubers, cleanse them from dirt, and empty them into a bag or basket.

Life Preserver.—James Bond, Norfolk, Va.—The object of this invention is to provide for public use a convenient, simple, and cheap apparatus, which, in cases of accident on the water, can be readily attached to the person, and by which anyone can easily and comfortably support himself in the water and at the same time propel himself rapidly along in any desired direction.

Machine for Gilding.—James Lick, San Francisco, Cal.—This invention has for its object to furnish a simple and convenient machine for gilding, by means of which the surface to be gilded may be applied to the gold leaf while in the book, thus rendering the ordinary cutting and handling of the gold leaf wholly unnecessary.

Mowing Machine.—Charles D. Mansfield, Lynn, Mass.—This invention has for its object to furnish a neat, simple, convenient, and effective mowing machine, which shall be constructed and arranged, that while doing its work quickly and thoroughly, it will have less side draft, and less wear and tear of the machinery, than mowing machines constructed in the ordinary manner.

Sleigh Brake.—John Maxson and Warren Kinyon, Scott, N. Y.—This invention has for its object to furnish an improved sleigh brake, designed especially for bob sleighs, but equally applicable to other sleighs, and which shall be so constructed that it may be conveniently reached and operated by the driver, and which will be entirely out of the way.

Combined Table Sink and Dish.—Thomas Ireland, Negaunee, Mich.—This invention has for its object to furnish an improved apparatus by means of which the laborious and disagreeable operation of dish washing may be greatly facilitated.

Wheeled Vehicles.—Samuel Jackson, Newark, N. J.—This invention called by the inventor an "Oscillating Wheel Carriage," has for its object to so improve the construction of the running parts of wagons, and other vehicles, that they may be easier for the horses, easier for those riding in them, and easier upon the vehicles themselves, making them less liable to be broken should one or more of the wheels strike an obstruction.

Corn Planter.—Nathan Breed, Jeffersonville, Ind.—This invention has for its object to furnish a simple, convenient, accurate, and effective machine for planting corn, which shall be so constructed and arranged that it may be readily made to plant the corn in accurate check row.

Band Drawer.—B. W. Field, Ferrisburgh, Vt.—This invention has for its object to furnish a simple, convenient, and powerful instrument for drawing the patent wire bands, or other bands, upon bales of hay, straw, broom-corn, cotton, or other materials, put up in bales, and which shall, at the same time, be so constructed as to be conveniently operated.

Combination Tool.—Edwin Froggatt, Central City, Colorado.—This invention relates to a new tool, which is to be used by blacksmiths, and other mechanics, for various purposes, and in which the most important tools, namely, the hammer, screw-driver, wrench, and pincers are combined in such manner that either can be used with great facility.

Attachment for Sewing Machines.—H. M. Hall, Danby, Vt.—The object of this invention is to provide an attachment for sewing machines which by the permutation of its devices will hold or guide the goods in any one of the several operations, such as the operation of seaming, binding braiding, tucking and marking, gathering, hemming, quilting, stitching and others.

Tweer.—J. C. Wilson, Coalburg, West Va.—This invention relates to improvements in tweers, having for its object to provide an arrangement whereby two fires may be blown simultaneously from the one tweer, for convenience in heating large work, or two large pieces, for welding.

Crate.—L. A. Lindsey, and J. F. O'Sullivan, Jackson, Miss.—This invention relates to improvements is packages for shipping fruit, vegetables, poultry, and for other purposes, whereby it is designed to provide crates of simple and cheap construction, which may be readily folded, so as to occupy but little space, when it is desired to transport them empty or to store them.

Nut Locking Device.—P. Philippi, Beardstown, Ill.—This invention relates to improvements in nut locking devices for preventing the nuts from becoming loose upon fastening bolts, and designed more particularly for locking the nuts of bolts used for fastening fish plates. It consists of a bar having mortises through it or notches in the ends, or sides, to fit the nuts, to be placed on the surface of the fish plate against which the nuts are screwed, so as to engage the nuts in the said notches or mortises, and being held in said position by a bolt or bolts, projecting from the said surface and held by spring keys, thereby locking the said nuts and preventing their disarrangement.

One-wheeled Velocipede.—T. W. Ward, New York city.—This invention relates to certain improvements in that class of one-wheeled velocipedes, in which the driver's seat is arranged above the wheel, it being pivoted to the axle of the same. The invention has for its object to provide for an easy balancing of the frame, and consists in attaching weights to the lower end of the seat frame, whereby the same will be retained in a vertical position. The balance can with this weight attachment not be so readily lost as without, and the operation of the one-wheeled velocipede is made easier and more practicable.

Cotton Seed Planter.—D. H. A. Sanders, Senatobia, Miss.—This invention consists of a hollow, hexagonal cylinder, capable of vertical play, mounted on runners, with openings at the salient angles of the sides, in the center to deliver the seed in front, behind a grooved plow, and behind, in front of a scraping covering device, the seed delivered in front being covered by the said cylinder.

Machine for Making Powder.—Wm. Silver, Bloomsburg, Pa.—This invention relates to improvements in the glaze barrels or cylinders commonly used for mixing the component parts of blasting and other powder, designed to ventilate the same, whereby the operation is rendered much safer and may be accomplished better and in less time. The invention consists in the application of spring valves to the cylinder, to be opened at certain periods of the revolution of the cylinder, to allow the escape of the damp and explosive gases generated within and the admission of fresh air.

Throttle Valve.—Charles Doughty Allen, New York city.—The present invention relates to new and useful improvements in throttle valves, the same being operated upon by the governor, in such a manner that in the event of anything giving way or breaking, the throttle valve will immediately close and shut off the steam, and will also close itself should the engine run too fast, for as the balls of the governor raise they will draw the throttle shut.

Plumb Level and Guide Line Holder.—John Bryant, Akron, Ind.—This invention relates to new and useful improvements in an instrument or apparatus for plumbing and leveling for various purposes; and it consists in a novel construction and arrangement of parts.

Apparatus for Clearing Spiked Cannon.—Thomas J. Dobbs, Weehawken, N. J.—This invention relates to a new and useful device for clearing the touch-hole of the cannon where a cannon has been spiked.

Firearms.—Richard S. Lawrence, Hartford, Conn.—This invention relates to new and useful improvements in firearms, having more particular reference to the class of firearms known as "Sharp's rifles," but which improvements (either in whole or in part) are applicable to other descriptions of firearms.

Preparing Tan Bark.—N. Spencer Thomas, Painted Post, N. Y.—This invention relates to a new and useful improvement in the process of preparing bark for tanning purposes, whereby the tan bark used is freed from its impurities, and rendered much more suitable for the purpose intended than when prepared in the ordinary man

Medical Compound.—Mrs. A. W. Kidder, South Norridgewock, Me.—The object of this invention is to supply a simple and safe family medicine, which operates to cure or palliate all diseases arising from an impure state of the blood, by purifying and invigorating the blood. Its general effect is tonic and cleansing.

Cultivator.—J. B. Jay, Arlington, Ill.—The object of this invention is to produce a cultivator, on which the shovels are made up and down adjustable, and at the same time, so hung that they can be slightly oscillated to avoid stones and other obstructions; another object is to protect the driver as well as the animal from excessive heat, or other inclemencies of the weather.

Bird Cage.—J. Maxheimer, New York city.—This invention relates to a new manner of connecting the top of a bird cage to the bottom of the same, with a view of utilizing material and of obtaining a better fastening. The invention consists in the application of a rod, which is fitted through an eye or loop, projecting from the bottom, and which rests on the upper edge of a band or ring of the cage top. This rod is not only a secure and economical fastening for the bottom, but forms, at the same time, a step or support for the bird.

Pump.—Alexander Friedmann, Vienna, Austria.—This invention relates to a new pump for elevating or forcing water by means of steam; and has for its object to reduce the shock produced by suddenly bringing the steam in contact with the water. The condensation of steam is, in such pumps, generally so sudden, and the consequent reaction so great, that much power is thereby lost. This invention effects a very gradual condensation, and at the same time, also a gradual expansion of the steam column, so that there will be no reaction and loss, but only a clear gain of power.

Churn.—J. E. Overacker, Redwood, N. Y.—This invention has for its object the construction of a churn, in which a current of air can in the most convenient manner be blown into the cream, beside using the most effective dashing apparatus. This combination of air and paddles, or dashers, will break the cream, and produce the butter much quicker than can be done by the dashing process alone. It will also cause a much more thorough buttering than could be done by the ordinary process, and will have less butter-milk.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,775.—Preserving Meat and Animal Matter, and in Apparatus employed for that purpose.—Thomas Sim, Charleston, S. C. Dec. 12, 1868.

161.—Propelling Machinery for Canal Boats and other Vessels.—Frederick R. Pike, New York city. Jan. 18, 1869.

372.—Machinery or Apparatus for Cutting Wire and Rods of Metal and other Materials.—W. C. Flinn, Nashua, N. H. Feb. 6, 1869.

451.—Apparatus for Forming Metallic Joints or Seams of Tin or other Sheet Metal.—Joseph Le Comte, Brooklyn, N. Y. Feb. 13, 1869.

762.—Preservative Paint.—Wm. Babcock, San Francisco, Cal. March 12, 1869.

788.—Traverse Card Grinder.—S. H. Wright, Lowell, Mass. March 15, 1869.

794.—Steam Vessels for Ocean and River Navigation.—S. W. Wilson, New York city, March 15, 1869.

816.—Safety Hook for Harness, etc.—Austin Baldwin, New York city March 17, 1869.

828.—Anchors.—J. D. Greene, Cambridge, Mass. March 18, 1869.

874.—Machinery for Felting Felt Cloths.—J. T. Waring, Yonkers N. Y. March 22, 1869.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING APRIL 6, 1869.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On each caveat	$10
On filing each application for a Patent (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$15
On an application for design (fourteen years)	$30

In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

88,535.—Rock-shaft for Gang Saws.—Ashbel P. Barlow, Kalamazoo, Mich.
88,536.—Can Opener.—F. G. Beach, Hartford, Conn.
88,537.—Tonic Bitters.—Robert Blacklidge, Bridgeport, Conn., assignor to himself and Charles Gerdenier.
88,538.—Submerged Pump.—Alonzo C. Blethen, Lynn, Mass.
88,539.—Screw.—Carl Bocking (assignor to himself and Coates Walton), Philadelphia, Pa.
88,540.—Breech-loading Firearm.—Francis E. Boyd and P. Shelton Tyler, Boston, Mass.
88,541.—Banjo.—Levi Brown, Baltimore, Md.
88,542.—Hydrant.—Samuel G. Cabell, Quincy, Ill., assignor to himself and Abbott Q. Ross.
88,543.—Reefing Fore-and-aft-sails.—Robert Chambers, Detroit, Mich.
88,544.—Casting Handles of Table Cutlery.—Nathan S. Clement, New Britain, Conn
88,545.—Manufacture of Artificial Stone.—François Coignet, Paris, France, assignor to L. Mangeon, New York city.
88,546.—Artificial Monolithic Structure.—François Coignet, Paris, France, assignor to L. Mangeon, New York city.
88,547.—Making Artificial Stone and Monolithic Structures.—François Coignet, Paris, France, assignor to L. Mangeon, New York city.
88,548.—Mode of Treating and Manipulating Cements in the Manufacture of Artificial Stone.—François Coignet, Paris, France, assignor to L. Mangeon, New York city.
88,549.—Process of Forming Artificial Stone.—François Coignet, Paris, France, assignor to L. Mangeon, New York city.
88,550.—Seal Lock.—G. M. Cooper, Port Huron, Mich.
88,551.—Edge Plane for Boot Soles.—Charles Coti (assignor to himself and John Baptiste Bebo), Marlborough, Mass.
88,552.—Pump.—John C. Crawford, Clintonville, Ill.
88,553.—Cradle, or Crib.—Eliza N. Cutter, Chicago, Ill. Antedated April 2, 1869.
88,554.—Medicine for Cure of the Gravel.—Benjamin W. Deal, New Market, Md.
88,555.—Banjo.—Frank P. Dobson, New York city.
88,556.—Spindle Step for Spinning Machines.—George Draper, Hopedale, Mass.
88,557.—Equalizing Cultivator.—Mathias Eichholtz, Troy, Ohio.
88,558.—Caster.—Wm. P. Elliott, Cincinnati, Ohio.
88,559.—Mold for Casting Augers.—William Evans and Richard E. Hayden, Seymour, Conn.
88,560.—Wrench.—Orlando V. Flora, Madison, Ind., assignor to himself and Charles Alling. Antedated March [illegible], 1869.
88,561.—Compound for Welding and Restoring Steel.—G. W. Fox, H. H. Coe, and I. M. Kelley, Ravenna, Ohio.
88,562.—Neck Yoke.—Hiram E. Goble, Lake Mill, Mich.
88,563.—School Desk and Seat.—George Huntress Grant, Richmond, Ind.
88,564.—Barrel Truck.—Eugene Grosjean, Pittsburgh, Pa., assignor to himself, Jacob Weaver, Jr., and Alfred H. Jones.
88,565.—Shutter Operator and Fastener.—George A. Harris and John B. Harris, Salem county, N. J.
88,566.—Clothes Dryer.—Elmer Hause, Tecumseh, Mich.
88,567.—Spring Hinge.—V. S. Herzog, Baltimore, Md.
88,568.—Churn.—Charles Hess, Lyons, Iowa.
88,569.—Farm Gate.—Edward Hill, Charles Ostrander, and Horatio A. Spink, Bainbridge, Mich.
88,570.—Process of Preparing Blue Peroxide of Manganese.—James W. Hobbs (assignor to Hobbs, Pope & Co.), Boston, Mass.
88,571.—Anchor Tripper.—James B. Hopkins, Dennis Port, Mass. Antedated March 23, 1869.
88,572.—Weather Strip.—Joseph Johnston, Chicago, Ill.
88,573.—Sash Holder.—Morton Judd, New Haven, Conn.
88,574.—Velocipede.—Wm. Lindon, New Haven, Conn.
88,575.—Gate.—S. L. Marsden, New Haven, Conn.
88,576.—Braiding Machine.—George Mason, Providence, R. I.
88,577.—Door Lock.—R. McDowell, Lambertville, N. J.
88,578.—Mode of Constructing Building Fronts.—Isaac S. Miller, New York city. Antedated March 23, 1869.
88,579.—Hub-boring Machine.—Daniel Murphy, Dubuque, Iowa.
88,580.—Teasel Trimmer.—Charles G. Nye, Onondaga, N. Y.
88,581.—Lock for Safe Doors, etc.—David O. Paige, Detroit, Mich.
88,582.—Comb.—Henry M. Paine, Newark, N. J.
88,583.—Fire Extinguisher.—William M. Parker, Boston, Mass.
88,584.—Beer Cooler.—Herman Pietsch and Moritz Walter, Milwaukee, Wis.
88,585.—Process of Hardening Steel Plates, etc.—George H. Porter (assignor to Porter Saw Company), Bristol, Conn.
88,586.—Felloe Sawing Machine.—John Rice, Bloomington, Ind.
88,587.—Book-binders' Head Band.—Julius Schlichting, New York city.
88,588.—Peg-cutter for Boots and Shoes.—William H. Sellers, Keokuk, Iowa.
88,589.—Anti-freezing Hydrant.—John W. Slocum, Philadelphia, Pa.
88,590.—Method of Making Yeast.—George Terry, Providence, R. I.
88,591.—Combined Hoe and Fork.—Benjamin L. Tibbets, South China, Me.
88,592.—Door Pulley.—Peter Joseph Tillmann (assignor to himself and John Reiser), Trenton, N. J.
88,593.—Horse Hay Fork.—J. F. Troxel, Bloomville, Ohio.
88,594.—Quilting Frame.—I. W. Valance, Troy, N. Y.
88,595.—Propeller.—Chas. Ward (assignor to himself and C. B. Palmer), Detroit, Mich.
88,596.—Stump Extractor.—J. A. Woodworth, Hickory Corners, Mich.
88,597.—Carriage Top.—R. H. Wright, New Bloomfield, Pa.
88,598.—Fluting Machine.—H. B. Adams, New York city.
88,599.—Throttle Valve for Steam Engines.—Charles D. Allen, New York city.
88,600.—Railroad Car Buffer.—Peter Allen and Benjamin Valiquette, Rutland, Vt.
88,601.—Attaching Sleigh Runners to Street Cars.—B. Aurbach, New York city.
88,602.—Fastener for Securing Springs to Bed Bottoms and Mattresses.—J. S. Barnum, Topeka, Kansas.
88,603.—Sewing Machine.—Chas. E. Billings, Hartford, Ct.
88,604.—Corn Planter.—Nathan Breed, Jeffersonville, Ind.
88,605.—Breech-loading Firearm.—Wm. Briggs, Norristown, Pa.
88,606.—Line Holder.—John Bryant (assignor to himself and A. L. Bailey), Akron, Ind.
88,607.—Hand Corn Planter.—Geo. Burson, East Palestine, Ohio.
88,608.—Toy Pistol.—Asa L. Carrier, Washington, D. C.
88,609.—Folding Desk.—Aaron Chandler, Davenport, Iowa.
88,610.—Syphon Bottle.—C. J. Converse (assignor to himself and James W. Tufts), Medford, Mass.
88,611.—Ferrule for Boiler Tubes.—Robert A. Copeland, Brooklyn, N. Y.
88,612.—Coffee Roaster.—Lyman B. Crittenden, Pittsburg, Pa.
88,613.—Potato Digger.—Ira Curtis, Des Moines, Iowa.
88,614.—Tea-Kettle Breast.—Z. Dixon, Bristol, Ill.
86,615.—Apparatus for Unspiking Guns.—T. J. Dobbs, Weehawken, N. J.
88,616.—Ladder.—R. L. Dodge, Portland, Me.
88,617.—Bedstead Fastener.—Justus Doering, Philadelphia, Pa. Antedated March 25, 1869.
88,618.—Rain-Water Conductor.—J. D. Field, Wataga, Ill.
88,619—Elastic Link for Clevis.—Louis Fliedner, Cleveland, Ohio.
88,620.—Steam Pump.—Alex. Friedmann, Vienna, Austria.
88,621.—Wrench and Pinchers.—Edwin Froggatt, Central City, Colorado Territory.
88,622.—Marine Furniture.—Edward Gallier, St. Louis, Mo.
88,623.—Wrench.—G. P. Ganster, New York city.
88,624.—Templet for Bending Springs.—Joseph Gatchell, Rahway, N. J.
88,625.—Door Spring.—Wm. Gilfillan, Syracuse, assignor to himself and M. T. Van Horn, New York city.
88,626.—Eaves Trough Bracket.—J. W. Gillespie, Alliance, Ohio.
88,627.—Cotton Cultivator.—A. J. Going, Clinton, La.
88,628.—Ship's Rudder.—T. F. Goodwin, E. C. Goodwin, and Chas. E. Goin, New York city.
88,629.—Churn Power.—I. S. Goolman, Monrovia, Ind.
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56,908.—Governor.—Dated August 7, 1866; reissue 3,359.—John Degnon, Cleveland, Ohio.
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21,161.—Reducing Wood Fiber to Paper Pulp.—Dated August 10, 1858; Antedated August 29, 1856; reissue 3,361.—Alberto Pagenstecher, Curtisville, Mass., Assignee of Henry Voelter.
35,058.—Cooking Stove.—Dated June 17, 1862; reissue 3,362. D. S. Quimby and D. S. Quimby, Jr., Brooklyn, N. Y., assignees of S. R Going.
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PATENTED NOV. 20, 1866.
Patented March 16, 1869.

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JOHN B. SCHENCK,
Schenck Machine Works, Matteawan, N. Y.
March 23d, 1869.

OFFICE BUFFALO CITY WATER WORKS, No. 20 West Swan st., Buffalo, April 6, 1869.

NOTICE TO WATER ENGINEERS.—The City of Buffalo will pay premiums of $2000, $1000, and $500, for plans and specifications for certain improvements in the Water Works supplying said city.

☞ Particulars in relation to the improvements required will be furnished Engineers by mail, by addressing A. R. KETCHAM,
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AT AUCTION.

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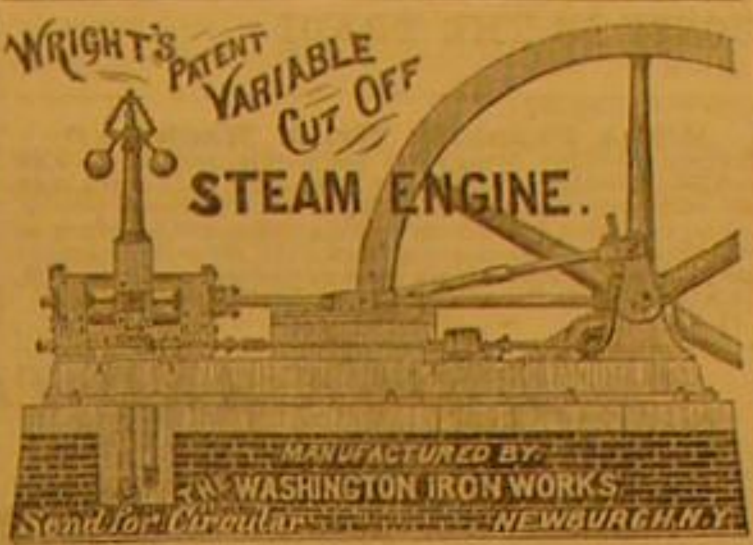

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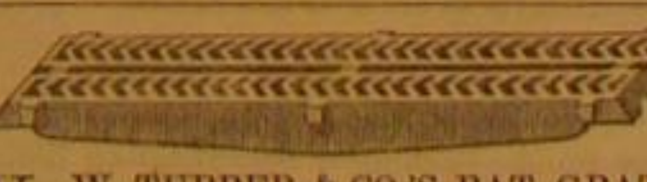

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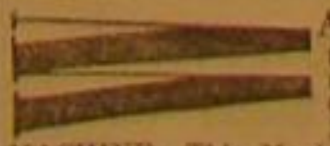

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