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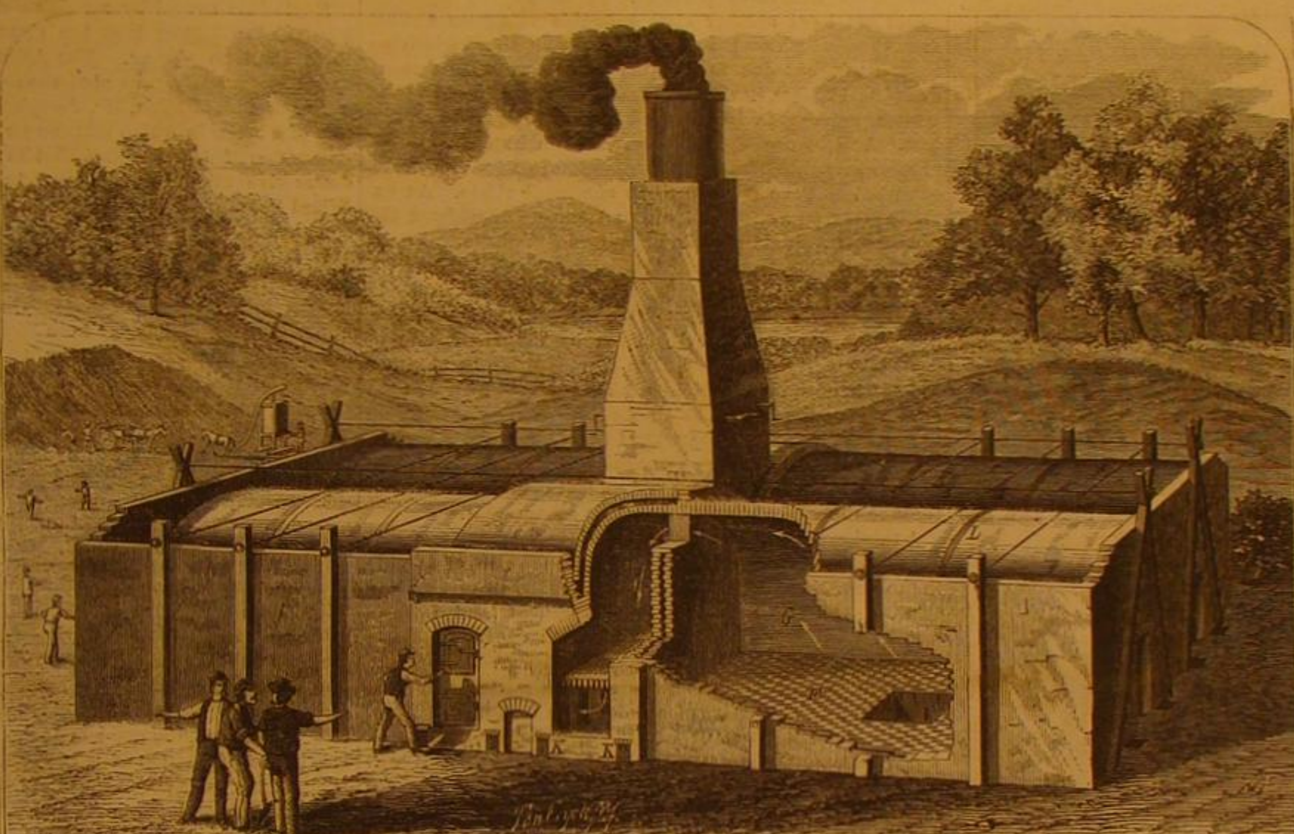
Improved Brick Kiln.

Scientific men, for the past few years, have devoted themselves anew to a study of the laws of heat; and a philosophy has arisen which effectually disposes of the old notions about caloric and its properties. Among other things, the subject of ventilation has undergone a thorough revolution; it has been found necessary, in order to produce a comparatively uniform temperature throughout a room, to exhaust from the bottom, thus absolutely inverting the old method of providing an inlet for heated air in the floor and an exit at the ceiling. Heated air tends in an upward direction, and this is based upon the natural law which causes all fluids to seek a level according to relative weight or specific gravity; therefore, when we desire to secure an equal temperature everywhere upon the same level in a room, whether it be the moderate temperature of a dwelling or the intense glowing heat of a burning oven or kiln, we must exhaust from below.

This principle has lately been happily applied, and with complete success, to kilns for the burning of bricks, tiles, and wares of different kinds. And in this direction we take pleasure in referring to the subject of our illustration, "The Hawley Kiln."



THE HAWLEY BRICK KILN.

Fig. 1 represents a perspective view, showing the left hand anterior chamber in process of burning, while a part of the walls of the right hand chamber, furnace, and floor, is broken away in order to show something of the internal arrangement. Fig. 2 is a vertical section, with arrows showing the course of the currents during the process of utilization of heat. Fig. 3 is a diminished foundation plan, showing the location of the wells for retaining condensed steam and ducts leading from the chimney. Fig. 4 represents a portion of the permanent floor of the burning chambers, showing the construction and mode of support.

(To illustrate the manner of burning the first chamber, refer to Fig. 2, left hand furnace and oven, isolating in imagination this part from the rest of the drawing. The course of the arrows, beginning at the ash pits, shows the direction of the currents during burning).

The room, A, is filled with green material, and the chimney damper, D, opened. The cold air draft to feed the fires in the furnace enters (through openings, K K, seen in Fig. 1) on each side of the ash pit doors, and rises in appropriate vertical flues until it enters the open space between the double arch over the furnace; thence it passes downward between the double side walls of the furnace, and enters the ash pit under the grate bars.

During the progress of burning, the furnace walls become intensely hot, and the incoming fresh air, by contact with these walls, during its transit to the grates becomes so highly heated as to ignite all the smoke and the gases generated from the fuel (whether wood or coal), thus securing almost perfect combustion.

The products of combustion rise upward in the furnace, B, and enter through the opening (in the direction shown by the arrows) into the burning chamber, A. Having no avenue of upward escape, the heated air spreads itself in a level stratum throughout the top of the chamber, displacing and expelling at the same time an equivalent in bulk from the bottom of the room into the sub chamber or condensing well, C, situated underneath the floor of the burning oven, from which it escapes up the chimney flue, controlled by the damper, D.

Hawley, by his method of burning, aims at an entirely novel process, which serves to distinguish his invention from all others who have adopted the down draft principle.

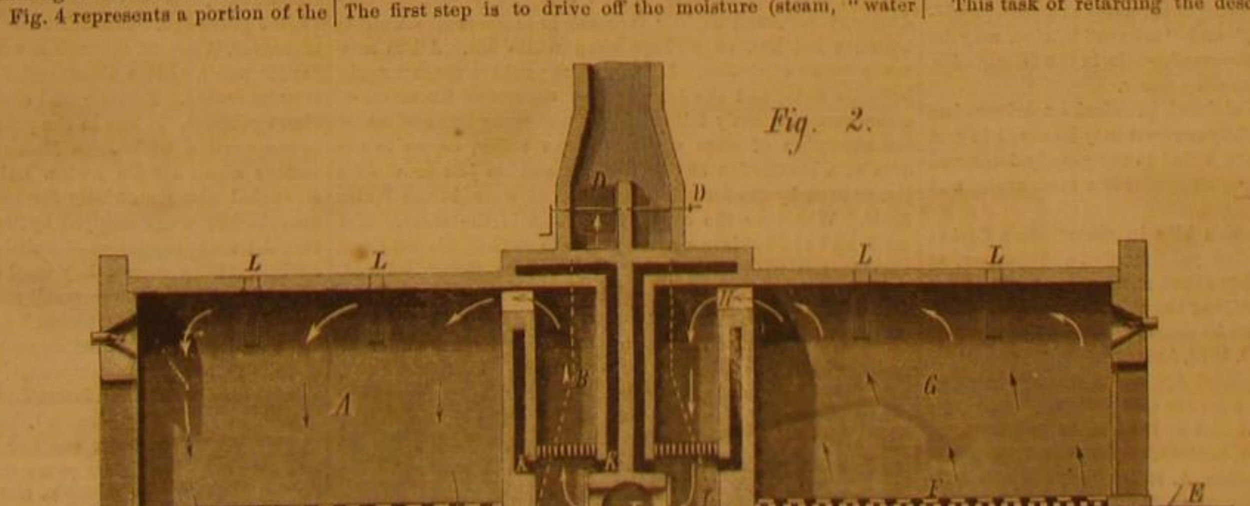
In all other kilns adopting this principle, there are two distinct stages to the process, namely, drying and burning. The first step is to drive off the moisture (steam, "water smoke"); and when this is accomplished, not before, a more intense degree of heat is applied to complete the burning process. During the latter stage, the heat passes almost without obstruction, indeed is conducted rapidly through the already dried and thoroughly warmed mass of material, and is carried forward into another room or oven, previously filled with green material in order to dry and prepare that for the final process. The experience of every observing brick burner shows that it requires a much larger expenditure of fuel to burn bricks to the proper degree of hardness after they have been completely dried by means of a slow fire; under such circumstances they say "the heat runs away from them," and they therefore strive to follow as closely as possible the line of "water smoke" with a sufficient degree of heat to complete the process; but as they approach the top courses in the kiln, the heat unavoidably escapes into the sky and fails to do its perfect work; and they therefore are likely to have pale or insufficiently burned brick to a greater or less extent, and no reasonable amount of firing will remedy this difficulty. This same defect is met with in all down draft kilns, when the drying off process is completed before heavy firing is begun, or where they pass the heat from the already dried oven over into a succeeding one, necessitating much longer firing and, of course, a larger expenditure of fuel.

By Hawley's device, this defect is overcome. During his process of burning, the incoming heated air generates steam freely from the green material contained in the oven; this steam gravitates in a level stratum, is condensed below (thoroughly saturating the material), and acts as a sort of automatic damper, which resists or retards the closely following or descending stratum of ignited gas which, at a white heat, is thus caused to expend its force completely, above; for while this steam damper prevents the escape of heat, at least above the steam point (212° Fah.), it does not materially obstruct the natural draft. This action is analogous to the formation of clouds around mountain peaks by the condensation of moisture from ascending warm currents of air.

This task of retarding the descending stratum of intense heat until after it completes the burning process, through and below the lowermost courses in the burning chamber, is effected by providing the sub-chamber or well, C, under the floor, F, of the oven, in which the descending steam is received, condensed, and retained in sufficient quantity to effectually arrest the escape and consequent loss of heat until the process of burning is completed.

In the burning of material requiring extraordinary and prolonged exposure to intense heat (fire brick, etc.), he finds it necessary sometimes to furnish an artificial supply of water in this well, to be generated into steam (damper) and thus check for a longer time the escape of heat up the chimney.

Fig. 2.

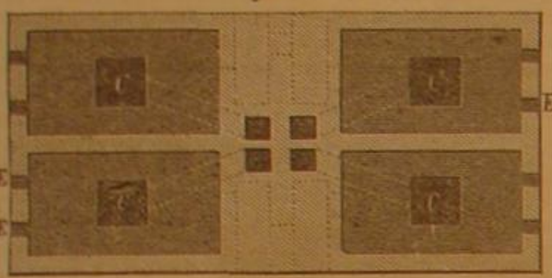


Another and almost equally important feature is his admirable method of utilizing the immense amount of surplus heat stored in the material just burned.

To illustrate the utilizing process, we again refer to Fig. 2, where we will imagine the process, just above described, as having taken place in chamber, G, instead of A; therefore, the right hand chamber is now filled with a glowing mass of hot material. The left hand chamber, A, is filled with green material. The damper, D, to chamber, G, is closed, thus closing the outlet from under the floor into the chimney. The damper, D, of the chamber, A, is opened, the dampers controlling the communication between the ash pits, I, of the furnaces are opened, the direct draft dampers are shut (see K K, Fig. 1), and the dampers at E, for the cold air inlet under the floor of the hot oven, are opened.

By the course of the arrows, it may now be seen, the inventor takes all his draft in at E, and converts the whole incandescent mass contained in the oven, G (equivalent in fifty thousand bricks to three and one half tuns of coal, all in a state of actual combustion), into an enormous furnace, passing this torrent of heated air over into the chamber, A, and thus using it at the proper stage for a hot blast, and under the furnace, B, and at the same time cooling rapidly and safely the contents of G.

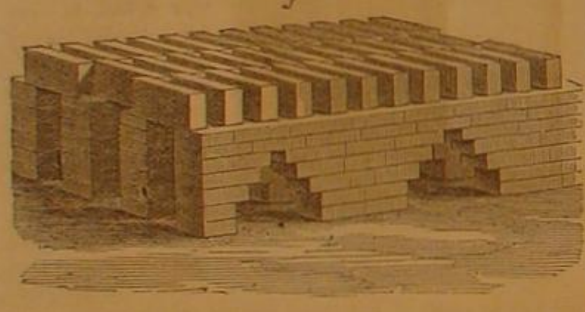
Fig. 3



By means of the sub-duct, J, connecting all the ash pits, the heated air may be transferred to either of the burning chambers at discretion; or by a prolongation of the sub-duct, J, outward, any desirable amount of heated air may be conveyed to the outside structures for drying or other purposes.

The ovens, being constructed in a group of four, permit continuous operation; cooling one while burning another, charging the third, and discharging the fourth, all at the same time. The feature, also, of their double walls separated by a dead air space (to prevent cold air from coming in direct contact with inner and heated walls, thus preventing them from cracking) renders this kiln far more permanent and lasting than if thicker and solid walls were used, and at the same time reduces its cost.

Fig 4



While the saving of fuel is an item of vast importance to all interested in burning processes, and while, on scientific principles, we think that no other kiln or oven extant presents equal advantages in this direction, save, perhaps, the single exception of the celebrated German kiln of Hoffman, a scarcely less important feature is that of the greatly improved average quality of the stock turned out.

In the common grade of bricks, for instance, the general appreciation in value, by having them uniformly hard (avoiding "benches," "clinkers," and "salmon" bricks), may be reckoned as at least $1 per thousand, while, in the finer grades, the difference is of course much greater.

In the Hawley kiln, it is claimed, practical experience has demonstrated that at least fifty per cent may be saved in cost of fuel alone; and this, when added to the greatly improved quality and value of stock, must render it a most useful and important invention.

We have not only seen this kiln in operation on Croton front bricks, at the extensive yards of Cox and Barlow, at Croton Landing, N. Y., but have been shown a certificate from this firm, substantially verifying the claims herein set forth.

The invention is protected by three separate patents, dated respectively, September 20, 1870, August 22, 1871, and April 2, 1872; also by a reissue dated April 2, 1872. Applications for patents in foreign countries are now pending.

This kiln is equally important and valuable to all manufacturers of tile, terra cotta, pottery, queen's ware, etc. Address, for further information, A. R. Morgan, proprietor of the Hawley kiln, 103 Fulton street, New York.

The Iron Interest.—One hundred and forty thousand operatives are employed in the production of iron in the United States; 42,000 of these are employed in preparing ore and fuel; 25,000 in preparing fuel for rolling mills; 42,000 in the rolling mills; 12,500 in blast furnaces; 3,500 in bloomeries; 800,000 are engaged in manufacturing articles of iron. Thus we have a total of 925,000 men employed in the iron interest. The value of pig iron manufactured last year was $75,000,000. The product of the rolling mills and forges was $63,000,000, the value of other manufactures was $762,000,000, and the entire value of manufactured iron for the year was $900,000,000.

ON THE HEATING OF WATER AND BOILERS.--CURIOUS EXPLOSIVE PHENOMENA.

A large proportion of all the explosions that occur are produced by a continuous increase of pressure without the means of escape.

Of these, many are caused by a defective state of the safety valves. Any cause that shall obstruct or prevent their free action will cause a rapid increase of steam pressure. Such obstruction may occur as a result of unequal expansion in the metal of which the valve is composed, or in the steam-pipe which supplies steam to it. Says the *Evening Mail:*

Some of the most violent explosions upon record are traceable to this easily preventible cause.

The accumulation of scale or sediment upon the bottom of the boiler will eventually weaken it. Another method by which the strength of the boiler may be diminished is found in the negligence of the engineer when he permits the water to become too low in the boiler.

All these causes are simple enough. No one will pretend that explosions resulting from them can in any sense be called accidental. Defective construction, negligent management, remiss attention, the whole catalogue of agencies by which man's negligence is put to test or his sense of danger dulled are antecedents of that class of explosions which we refer to the increase of pressure.

But we have another class referable to causes distinct from those which we have stated. They are those which we name explosions due to unequal expansion. Thus many cylindrical boilers, having the feed water introduced on the bottom, are broken by the cooling and contraction of the iron. A difference of temperature of two hundred degrees or more may thus occur in the same plate; so that its different portions are subjected to an enormous strain. An explosion may occur from an unequal expansion without the presence of a single particle of water in the boiler. In one remarkable case, a man was clearing an empty boiler from scale and sediment, and finding these adhering too firmly to the inner surface of the boiler to be easily removed, conceived the plan of loosening them by the application of heat. He therefore lighted a fire of pine shavings at either end of one of the principal flues. This caused an irresistible expansion of the flue. The shell of the boiler was not able to resist the enormous force thus developed, and a violent explosion was the result. The head of the empty boiler was blown off in the most sudden and violent manner, and driven through the wall of the building that contained it.

A third cause of explosions is found in what we may call "repulsion of the water." There may be no sign of trouble in the condition of the water in the boiler. The temperature of the boiler may not be elevated, at least in any way that subsequent examination would disclose. There may be no indication of weakness in the boiler.

Any of our readers who have seen a drop of water fall upon the smooth surface of a heated flat iron have noticed that it does not touch or wet the heated metal, but rolls about its surface like a marble on the floor. This it will continue to do for some time without evaporating. The little globe of water is surrounded by a thin film of vapor, which protects it from the action of the heat, and prevents it from touching the metal.

This phenomenon is known as the "spheroidal state" of water. The same state may be produced within a steam-boiler, at least in a portion of the water that it contains. When the fires under a certain part of the boiler are especially intense, they may so violently heat the metal above them as to drive away from it, in spite of the pressure which forces the water down, that part of the water which is directly above the heated iron. A thin film of vapor is now interposed between the metal and the water. The iron thus separated from the good conductor with which it has been in contact, and covered only by the comparatively poor conductor, vapor, will rapidly increase in temperature until it becomes red hot, or perhaps even white hot. All is now ready for an explosion. Let any force produce contact again between water and the iron, and an enormous liberation of steam must instantly follow. This force may be supplied by the admission of more water into the boiler, or, as in the case of a locomotive engine, by any sudden jolt or violent jar, or even by the forcible circulation of water in the boiler itself. Whatever the cause, the result is the same. Hot water and red hot iron are brought into sudden contact; and nothing can withstand the explosive force thus produced. When the water once strikes violently, the soundest iron may be broken and the strongest workmanship be destroyed.

Mr. Robinson made numerous experiments in which he produced these explosions by repulsion. In these cases, however, he guarded against dangerous results by employing safety plugs composed of weak metal, which broke at the first explosion of steam. In these cases, says he, "there were no indications whatever of trouble in the boiler till the plugs broke."

In Paterson, New Jersey, an explosion of this character occurred in the case of a locomotive engine just finished. But a moment before the crash, the safety valves indicated a very moderate pressure. In an instant, a considerable portion of a three story workshop was blown down; four men were instantly killed, and a number of others were injured.

The last causes of explosions which we have to consider are those due to what is called overheating of the water.

Water by long boiling loses the air which it contains in solution. The result of this deprivation is, little by little, to raise its boiling point. A French experimenter, M. Denny, found that by careful heating he could raise water to the temperature of 275° Fahrenheit before it vaporized. By his careful treatment, the water had been freed from the air it contained. In consequence, its particles adhered more closely to each other than those of water in its ordinary condition, and it resisted vaporization. But when the heat grew so great as to overcome this cohesive force, the water vaporized with a sudden explosion. An open pan of boiling water, which had been thus freed of its air, has exploded with fatal results. As one class of explosions already described have occurred without any water in the boiler, so the present explosions may occur without any boiler. Either water or metal alone may thus fatally explode upon the application of heat. In the cases now under consideration, the water, gradually freed from its contained air by heat long maintained at or near its boiling point, trembles just upon the brink of a sudden explosion. When more heat is added, or when the pressure is reduced by starting the engines, the sudden vaporization will occur, and the whole mass of water contained in the boiler will flash at once into steam. The resulting explosion is often of the most terrific character.

Such is the nature of explosions in which the shells of boilers have been shattered when the steam pressure and the fires are low. It is pleasant to know that they may be prevented by the use of safety plugs, so constructed as to be broken by a very low pressure. The gradual escape of the overheated water is thus provided for; and the temperature of the fire will be reduced without any dangerous agitation of the water.

Explosions caused by repulsion may be prevented by so constructing boilers that the circulation of water within them shall be perfect. The American Academy of Arts and Sciences lately presented the Rumford medals to an engineer of Philadelphia, Mr. Joseph Harrison, for the invention of a boiler in which this danger is guarded against. The Committee of Award stated that in this boiler a violent or destructive explosion is almost impossible. Mr. Norman Wiard has also devised a boiler in which the same result is attained.

It is of importance to remember that in no case will any contrivance, or patent, or invention take the place of human intelligence and watchfulness in preventing accidents. No patent has yet been discovered which will take the place of the human brain. An engineer whose wits are about him will prevent a bad boiler from bursting, when a careless one would destroy the strongest boiler in use. And when the public, through the courts, insist that boilers shall *not* burst, ample means will be found to prevent boilers from bursting.

CARPETS AND KNITTED MANUFACTURES OF AMSTERDAM, NEW YORK.

Amsterdam lies in the Mohawk Valley, about thirty-three miles from Albany, on the line of the New York Central Railroad. From the hights above the valley, the Chuctanunda Creek rushes at right angles through the town into the Mohawk river, and furnishes ample water power to the numerous mills built along its course. A bale of wool ought to be, if it is not, the emblem of the town of Amsterdam, for it is in the production of woolen manufactures that the majority of the mills are engaged.

I should think it would be difficult, says a correspondent of the New York *Times*, to find in the State of New York a village, of the same size as Amsterdam, which displays more manufacturing enterprise; for, although the manufacture of knitted goods forms by far the largest single branch of its business, knitting is not the only business carried on in the place. There is a large boot and shoe factory, a linseed oil factory; the seed crushing mill of Kellogg and Miller, which can turn out 2,000 gallons of oil a day; the paper mill of Stuart and Carmichael, for making paper four strand; Shuler's steel carriage spring factory; MacElwain's turbine water wheel works; and other smaller factories.

Wool knitting by machinery, as it is now carried on in Amsterdam, is a very different thing to what it was ten or twelve years ago. Invention has done marvels for it; and moreover, it passed through a very troublous childhood. In fact, it was for some time doubtful whether the babe would ever be reared. Fortune and circumstances seemed to combine against it. It was in the year 1857 that Adam W. Cline, in conjunction with John Maxwell, built a small knitting factory about a mile and a half from the village. They struggled along manfully for two years, but in 1859 their manufactory was destroyed by fire. Fire is the one great antagonist that proprietors of knitting factories have to contend against. They cannot buy wool suitable to their purposes which is not apt to have small stones in it; and as the wool is passed through the "picker" which separates it, a spark is often struck from one of these little stones, and the flimsy mass is in a blaze in a moment, and of course soon communicates the fire to the inflammable material piled about in all directions. Nothing daunted, however, by his misfortunes in 1859, Mr. Kline built another knitting factory in the following year. For some years business prospered, but just as Mr. Kline was beginning to feel himself firmly established, his factory was again destroyed by fire in 1866. In the meantime, other factories had sprung up, four new ones have since been built, and in 1868 Mr. Kline rebuilt his factory, and is now running it most successfully in partnership with his son, Harlan P. Kline.

A short time ago, a lady wrote to the New York *Times* asking in what branches of manufacture in the State, girls and women are employed. She should visit Amsterdam, and see the number of females employed there. In the knitting mills, nearly all the employees are girls; while at Mr. Stephen Sanford's carpet manufactory, in the upper part of the village, out of a labor force of 700 hands, the bulk of the operatives are women and girls.

The knitting machine is a circular parcel of needles, something like elongated crochet needles, in and out of which the strand of wool is passed by machinery which knits it into stitches as it goes along.

The leading knitting factory is that of William K. Greene's Sons. They employ 200 hundred hands, on thirteen sets of machines. Their average daily production is about 200 dozen of shirts and drawers, of different sizes. The business of Schuyler, Blood, & Co., is nearly one half that amount. Among the older firms, there are A. W. Kline & Co., McDonald, Kline, & Co., John M. Clark, McFarlan & Marcellus, and the American Hosiery Mills, where they make a coarse grade of knitted stockings and socks. The two new mills in the village are owned by De Forrest & Wanner and Phillips, Dent & Lowden.

HOW CARPETS ARE MADE.

Mr. Stephen Sanford's carpet manufactory is supposed to be the most extensive one in the United States under one sole proprietorship and management. The average production of the factory is one thousand yards of carpet a day.

None but the very commonest wool is suitable for carpet manufacture. The finer wools have not sufficient toughness and fiber to enable them to resist the rough wear which a carpet always gets.

The wool is first of all thoroughly washed, and is then thrown, completely saturated and dripping, into the hydraulic extractor, a large receptacle, something like a huge cauldron, which revolves very rapidly. A few seconds after the extractor is started, the wool and the cauldron alike are lost to sight from the rapidity of revolution. I asked the operative who had charge of it how many revolutions the extractor made in a minute. He replied, "Three thousand, Sir." Such a momentum appears almost incredible. The extractor is about four feet across; therefore, a given spot on it would travel a distance of twelve feet 3,000 times in one minute, or at the rate of 410 miles an hour. In a few minutes, what was dripping wool is taken out so nearly dry that there is only a slight feeling of dampness to the touch. The wool is then taken upstairs to the drying room, where it is laid out in layers on extensive sheets of wire netting. A powerful blast of hot air is forced into the room, and an undercurrent downward through the wool. By this means, the wool is quickly dried and is ready for combing, drawing and carding. The spinning of the wool seemed to me an endless business. At first, the strands are as thick as your finger; but they are spun again and again, each time into a smaller strand, till they have been reduced to the required fineness. The wool is then wound from the bobbins into skeins, and is sent away to the color house to be dyed. The brighter colors of the dyed skeins have a very gaudy appearance. But this gaudiness is lost in the careful harmonizing of colors in the process of weaving. It has often been a mystery to me how they weave such beautiful and many colored patterns in carpets; but putting the machinery on one side, it is a very simple operation to watch. The pattern is punched on a series of plates of thick card board, certain holes corresponding to certain colors, and the pieces of cardboard being fastened together like the photographic plates in a revolving stereoscope. The cardboard pattern presses against the pins which govern the many cords forming the web and the woof; and, of course, where there are holes the pins pass through the card board, and so allow certain of the cords to take a different position as the shuttle flies backward and forward. The weaver stands before his loom with as many shuttles on either side of him as he has colors to weave. The shuttles are placed one below the other; and by raising or depressing them with a lever, the right shuttle is brought into play. When the weaving of the carpet is completed, it is carefully gone over by experienced hands, and all lost and faultly stitches are put in with a common carpet needle. But the carpet is covered all over with short woolen bristles. To remove these, it is passed through the dresser, a machine very similar in its operation to the mowing machine; for as the carpet passes through the dresser, the bristles are all removed by a series of knives, arranged like those of a mower.

ON COTTON SEEDS.

BY HORATIO N. FRASER.

Since small hullers have been introduced on many of the plantations, the planters are enabled to hull their own seeds. These are thrown into the top of the hullers, and first come in contact with knives, which cut the hull; then they are passed through sieves, by which process the kernel and hulls are separated. The kernel is divided into two portions; the first is that part which has been broken or cut by the knives; this is ground to make the meal used for feeding, and constitutes one third of the whole weight of the kernel. The remaining two thirds come out whole, and are sold for other purposes. This meal has been found to be as rich, in flesh and fat producers as linseed meal, for stock, and supersedes the use of it in the cotton growing States. The hulls are piled in heaps until they arrive at the right state of decomposition to be used as a fertilizer, for which they are well adapted, being rich in the phosphates and lime, characteristic of substances used for this purpose. The seeds contain a fixed oil to the amount of about thirty-seven per cent of the weight of the kernel, most of which is obtained by expression.

At the factory on Long Island, which the writer visited, the seeds are bought with the hulls on, although the whole kernel is generally brought directly from the planter. These are first thrown into a gin, which separates some more of the lint. This is packed in bundles and sold for ordinary cotton batting. From this, they are conveyed to the hullers and undergo the decorticating process. The kernel is then carried by an elevator to a box which feeds two large iron rollers, converting it into meal; the meal is put into a large vessel, heated by steam to render the oil more fluid, and then is put between iron plates which are forced together by hydraulic pressure, which presses out nearly all the oil and some mucilage. About eight per cent of oil is left, which cannot be removed except by solvents. This oil, as then obtained, is of a handsome dark wine color and sweet taste. This then undergoes the purifying and bleaching process, which is kept a secret by the manufacturers.

The purified oil is either a golden yellow or white color. An oil is also produced, by chilling the purified oil and expressing, to obtain a variety almost free from stearine, called by the manufacturers "winter oil," from the fact that cold will not thicken it.

This oil is used extensively in the arts, chiefly to adulterate and substitute higher priced oils. Cheap paints are ground in it, and it is used to a certain extent to adulterate linseed oil. But being a non-drying oil, only a small percentage could be used.

It is also used for adulterating sperm oil for burning, and for mixing with lard oil. The most practical way to detect these is to heat the suspected oil with distilled water; separate the water and add a solution of subacetate of lead. If it contained cotton seed oil, a white precipitate will be formed on account of the presence of mucilage, which is always found in this oil. If the sperm or lard oil is pure, it would be indicated by the absence of any milkiness.

It is also used to adulterate olive oil, and chemistry has found no practical mode by which they can be definitely distinguished apart.

A soap has been made of the residue left after refining. It is of a more or less dark brown color and disagreeable smell. It is used in the laundry, and sells at from three to seven cents a pound, according to quality. It was also attempted to make a soap from the white oil. This, when first manufactured, is of a handsome white color, but after standing some length of time it becomes dark and finally almost black. It is not made now.

It is used to the amount of ten per cent in making fancy soaps, to give them a good lather, for which the oil is said to be the best known; but even in this small amount, the odor of the rancid oil can be detected.

The hulls are used for fuel in the factory, and the greater part of the cake meal was sent to Europe, the farmers of this country, at that time, not being generally acquainted with its properties. It sold for about thirty dollars a tun.

A few years ago, the oil was noticed in the journals in connection with preparations of pharmacy, to be substituted for oils in liniments and ointments, for which it is adapted by its properties as an emollient; but nothing definite was arrived at. Being cheaper than even the commonest grades of olive oil, and resembling it so much in its behavior, it is peculiarly fitted for the preparations of the pharmacopœia in which the olive oil is used. Mixed with aqua ammoniæ in the officinal quantities for "Liniment. Ammoniæ," it makes a product which has all the essential properties that are indicated by the olive oil, and has the advantage of not forming so thick a mixture, thereby making it more convenient. In the "Liniment. Camphoræ," it seems to serve exactly the same purpose as the officinal oil.

Lead plaster made with the cotton seed oil has been substituted with advantage for the officinal, and has been used to mix with it to the amount of fifty per cent by some manufacturers of the plaster. This, made with the cotton seed oil alone, forms a handsome, light colored plaster, apparently equal in all respects to the English, with the exception that it does not become hard enough to keep its shape, in the usual form of selling it. But when mixed with olive oil in equal proportions, this difficulty is entirely overcome.

The cost of the plaster made with the cotton seed oil, using the best English litharge, is twenty cents per pound. This difference in the cost, combined with the practicability of using it, will recommend it to the more careful examination of druggists who deal extensively in this preparation.—*American Journal of Pharmacy.*

Origin of Microscopic Living Forms.

In a recent lecture before the Scientific School of Yale College, Professor W. H. Brewer said: "The most reliable observers are overwhelmingly of the belief that all life is from antecedent life, or, in the words of the old Latin aphorism, *omne vivum ex vivo.* And each good investigation reduces the number of supposed cases of spontaneous generation.

The facts of the case may be stated as follows: 1. The old view of organic and inorganic compounds in chemistry has been broken down. 2. All allow that beings do arise where the germs cannot be distinguished by the best microscopes yet made. 3. That some of these lower forms are so variable that what were once supposed to be several species are now known to be often only phases of the same thing. 4. Although it is highly improbable that all forms of living beings are derived from one original, yet many of the so called present species appear to have been produced from earlier similar species. The whole question must be regarded as yet among those that are unsolved, and should be approached in a candid and scientific spirit. I believe, said the lecturer, that it will ultimately be shown that all life is derived from antecedent life, and that the beginning rests with the Creator.

Some microscopists use instruments which magnify 5,000 or even 10,000 diameters. But notwithstanding the power of the instruments used, it should not astonish us if we cannot even then see the original germs. For let us make a simple calculation. Some of the great trees of California are over 300 feet high and 30 feet in diameter. Such a tree is estimated to contain 250,000 feet of lumber exclusive of the branches, or 36,000,000 of cubic inches. The cubical contents of a seed of one of these trees may be put at from $\frac{1}{1000}$ to $\frac{1}{2000}$ of a cubic inch, and its length at from $\frac{3}{16}$ to $\frac{2}{16}$ of an inch. In one of these trees, then, we have a living being from 10,000 to 15,000 times as large as the largest dimension of the seed—not the germ however—and from 50,000 to 75,000 million times its cubical contents. And if we may suppose suppose that the relation between these microscopic living forms and their germs is at all analagous, it is not unreasonable to consider that they exist, though we may not be able to see them.

But have these questions no practical bearing? Are they merely curious and interesting speculations? It is indeed a subject of immense practical importance. Diseases of both man and animals are caused by microscopic organisms. As samples of these may be mentioned, the itch, a disease known as favers, and all the phases of ring-worm. So also certain diseases of vegetables, such as rust, mildew, and blight of crops, the grape disease, and the potato rot. In all these cases, the animals are known to reproduce from others. There are also numerous other contagious and epidemic diseases, which seem to be of like character, although their causes are not so well known. Such are small pox, kine pox, and sheep pox. Extensive experiments, made on these diseases, go to show that the infecting material is minute particles, and the problem becomes to destroy them. It is also but a step from these contagious diseases to epidemic and malarious ones, such as cholera and the plague, although the cause is here more obscure. That treatment of these diseases, however, has been most successful which regards them as caused by living organisms. Some malarious diseases are checked by cold, as the yellow fever by a frost. The silk worm disease may also be placed in this category. The subject may be summed up as follows: 1. We know that some diseases are caused by minute organisms. 2. That others apparently are so. 3. That of those that are certainly so caused, the organisms are not spontaneously evolved. Beyond this, we are still in the dark, but every year brings a solution to some new case, and they all point the same way, namely, that these great scourges are caused by minute organisms not spontaneously generated. If so, the remedy is simply to keep the seeds or spores away from the body, but if they are spontaneously generated, there is no hope of extirpating them, and unless a specific is found the race must continually suffer.

Bone Felon Arrested by Congelation.

Dr. James B. Walker, of St. Louis, Mo., says, in the *Medical Archives*: Not long since I was consulted by a young lady who was suffering from an incipient felon. The distinguishing characteristics of the painful affection were already manifest—pain, throbbing, some tumefaction, and the nervous excitement, indicated plainly what was in advance, unless the inflammation was arrested; and the command was: Arrest it at all hazards.

The starting point had been two days previous to her applition for treatment. I could think of nothing offering such a prospect of success as cold, as low as the freezing point. Adding equal parts of snow and salt in a tumbler, I placed the finger, it being the middle one, in the freezing mixture. For a few seconds, there was an increase of the sensibility of the part, and it was with difficulty I could persuade her to hold her finger in the mixture. By degrees the pain subsided, and, at the end of two minutes, perfect insensibility had followed. I removed the finger, and after a few minutes the sensibility returned, and with it came the pain, throbbing, etc. The application was renewed, and the pain again ceased and insensibility ensued. This was repeated as often as the pain returned, and in about two hours, alternating the applition and removal, there was no return of the painful sensations, and the difficulty entirely ceased and there was no felon. The induration remained several days, and the skin gradually exfoliated.

Manufacture of Horseshoes by Machinery.

Our young and promising contemporary, the *Chronique de l'Industrie*, prints a communication from the pen of M. A. Verhaeren on the above subject. He gives it as his opinion that the most remarkable factory of the kind is that of MM. Mansoy et Cie., who supply the horseshoes used by the Omnibus Company and the Cab Company of Paris, and who, during the siege, furnished all the shoes required for the cavalry. The machinery employed by MM. Mansoy is described as very simple—a rolling mill, a shaping machine, two steam hammers, and two punching machines, with, of course, dies for each size of shoe made; the value of all this is said not to exceed $6,000. The hammers require 15 horse steam power, and a 6 horse engine suffices for all the rest; but, it is added, a 15 horse engine would probably answer all purposes. With the above machines, the company turns out 2,000 shoes a day with six laborers and three apprentices, and the space occupied by the factory is about four hundred square meters. The production is constant; when working only during the day, the fires are covered up at night, but when working night and day there is, of course, a considerable economy of fuel and working expenses. The engines are worked with the lost heat of the plate furnace, as in rolling mills.

THE ODORS OF PLANTS.—It may be laid down, as a general principle, that a larger proportion of white flowers are fragrant than those of any other color; yellow come next, then red, and lastly blue; after which, and in the same order, may be reckoned violet, green, orange, brown, and black.

MULLER'S IMPROVED ROPE RAILWAY.

Muller's Rope Railway.

The use of rope railways as a means for transporting heavy freights, mining products especially, has within the past five years become quite extensive. In England, Scotland, and on the continent, many miles of these railways are now in successful operation, and contracts for the erection of lines thereof, several hundred miles in extent, are now out. In Colorado, they are now in use to a considerable extent, and many new lines are being projected.

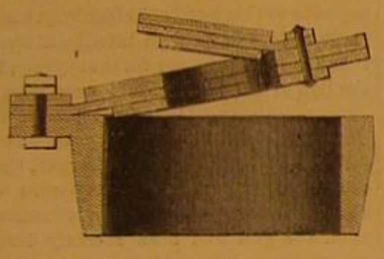
Among the especial advantages of the rope railway as a means of locomotion are its economy of first cost, the quickness with which it can be set up, and the cheapness of its operation. It consists of travelling ropes suspended on poles, the ropes taking the place both of the rails and the locomotive of the common railroad. On the rope railway, the burden to be carried is attached to the traveling rope, the movement of which is not affected by the form or grade of the surface of the ground. In this respect, it resembles a telegraph line, and works just as well whether it passes over the roughest chasms or the smoothest levels.

The improvement illustrated in our engraving is the invention of Mr. Hermann Müller, an Austrian engineer, and has lately been patented in this country. The distinctive features of the improvement consist in peculiar devices whereby the ordinary mining cars with their loads are transferred with facility from the usual ground railway tracks to and from the rope railway. This will be readily understood by a glance at our picture. It will be observed that, at each end of the rope railway, there is a drum of considerable size over which the traveling ropes pass. The ground tracks are arranged to run in connection with the upper and lower surfaces of the drums, and it is only necessary to push the cars, into contact with the ropes at either drum, in order to connect them with the ropes and effect the transport of the cars in either direction. Our sketch is not purely a fanciful one, for these railways are used in places far rougher and more inaccessible than the scene here represented.

This invention has for some time been in practical operation at Sigl's great machine establishment in Vienna (Austria) where it passes from the roof of one of the buildings over the fortification walls, ditch, and streets to a neighboring piece of ground pertaining to the concern. Its operation gives great satisfaction. The invention is particularly adapted for large manufacturing works, also for coal and mining purposes. It costs comparatively little for erection, and may be used in long or short sections. Further information concerning the expense of erection, plans, etc., will be furnished by S. S. Townsend, No. 31 Liberty street, New York, sole agent for the United States.

Noiseless Pump Valve.

Mr. H. Teague, of London, suggests the form of valve shown in our engraving, which is stated to be very effective and to operate without noise. It will be observed that an opening equal to one third of its area is made in the ordinary clack valve, and over this opening another valve is hinged. The two valves are thus arranged in opposite directions. This is a very simple and excellent invention.



Green Corn Fodder.

A correspondent of the *Country Gentleman* says: "Having three cows, and not having the grass for them, I concluded to soil them with sowed corn entirely. I commenced about the first of June, and have fed them bountifully ever since, with the aid of 18 or 20 heads of small loose cabbage apiece. Now for the result; The cow, that would have given on grass 20 quarts per day, now gives only 12 quarts; No. 2, instead of 14 quarts per day, now only 8; No. 3, a heifer that did give in the past winter, on dried stalks and feed, 6 quarts per day, now only 2 quarts. The three cows are perceptibly decreasing in milk every day, and I fear, by the time cool weather sets in, there will be more milk taken from the corn than from the cows. They have a shady, cool yard to run in during the day, and are stabled at night. I was always under the impression that sowed corn was a great supplier of milk. But I have come to the conclusion, so far as these cows show, that sowed corn fed alone and continually is not as valuable as we think. But grass and sowed corn fed together are all that we can ask."

Submarine Telegraph Cables.

A cable of the very best construction, containing four conductors, was manufactured and recently laid between Lowestoft, on the coast of Suffolk, Eng., and Emden, on the Hanoverian coast, for the German Union Telegraph Company, by the Telegraph Construction and Maintenance Company, and is now in perfect working order.

The conductors are of stranded copper, of excellent conductivity, weighing 107 lbs. per nautical mile, and insulated with three coatings of Willoughby Smith's improved gutta percha to the weight of 140 lbs. per mile, so that each insulated conductor weighs in the aggregate 247 lbs. per mile. The insulation, it is hardly necessary to state, is excellent.

The several "cores" or insulated conductors were wormed and served in the ordinary manner, and then sheathed with 12 No. 3 B. B. galvanized iron wires for the main cable, and with 12 No. 000 B. B. galvanized iron wires for the shore ends. Each type of cable was further protected with servings of tarred yarn and bituminous compound.

The length and weight of the cable necessitated its being laid in two sections, but the whole was successfully accomplished. The end landed on the coast of Suffolk, at Lowestoft, adds some additional importance to that place from a submarine telegraph aspect. This makes the fourth cable landed there. The others are the Lowestoft and Zandvoort north and south cables, and the Lowestoft and Nordeney (Reuter's), the property of the Post Office; this additional cable makes up a total of sixteen wires starting from that point for continental traffic. How strangely the traffic has grown since 1853, when one wire alone stretched across the North Sea. And now, in addition to the cables mentioned, there are other existing cables northward, which swell the number.

A cable well manufactured and laid on such good ground may be expected to last many years—take, for instance, Reuter's cable, separated by but a short distance from the German Union cable; how well that has lasted through these years! And, indeed, it would be vain to attempt to define the life of such a cable, when we have already the Dover cable still in existence and still working, of the ripe age of twenty-two years.

[For the Scientific American.]

FRICTIONAL GEARING.

BY E. S. WICKLIN.

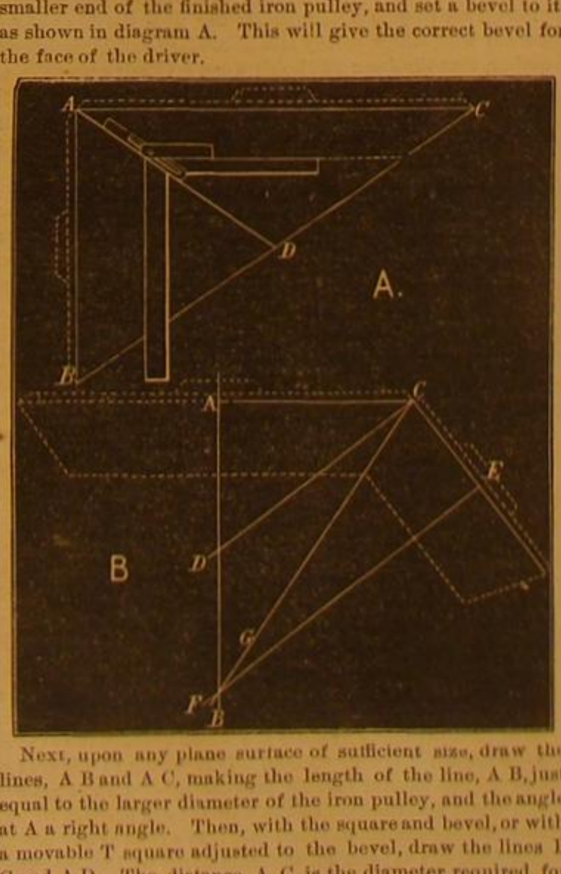
NUMBER IV.

Since the introduction of friction as a means of transmitting motion, it has often been desirable to apply the principle to bevel gearing. Frequently, however, this has been unsuccessful. The failures have resulted either from the want of a correct knowledge of the principles of bevel gearing, or from imperfect workmanship in the application of those principles.

When correctly and substantially built and accurately put up, bevel and miter friction pulleys, within certain limits, operate just as well as in the other form. True, we cannot in these, as in the cylindrical pulleys, extend the face *ad libitum* without greatly increasing the diameter; and for this reason, when great power is to be transmitted, it is not convenient to use this form of gearing. But in all fast motions, where not more than ten horse power is to be transmitted, the bevel friction is one of the best means of connecting at an angle. It may be adapted to almost any change of speed, and set to any angle, either right, obtuse, or acute, and has the same advantages in operation as the other form of friction. And when it is required to reverse the motion at pleasure, it is most conveniently done by setting two bevel pulleys upon one shaft, facing toward each other, and placing one, upon another shaft, between them so that it may be brought into contact with either.

In building this gearing, the iron cone, or pulley, is made similar to a bevel pinion, except as to the teeth, instead of which there is a smoothly turned face. The same care should be bestowed upon the accuracy of finish and balance that is required in the other form of friction pulley; but the pulley may be made somewhat lighter in the rim, as the conical form gives additional strength. In making the wooden driver—the iron pulley being furnished—the first point is to determine the exact diameter and bevel, for upon the correctness of these, to a great extent, depends the success of the work.

To obtain these dimensions, place a square across the smaller end of the finished iron pulley, and set a bevel to it, as shown in diagram A. This will give the correct bevel for the face of the driver.



Next, upon any plane surface of sufficient size, draw the lines, A B and A C, making the length of the line, A B, just equal to the larger diameter of the iron pulley, and the angle at A a right angle. Then, with the square and bevel, or with a movable T square adjusted to the bevel, draw the lines B C and A D. The distance, A C, is the diameter required for the driver, and the other dimensions are easily obtained.

To obtain the bevels for pulleys to work on shafts placed at acute angles, draw the lines as in the annexed diagram marked B.

First, draw the line, A B, to represent the driving shaft. Then, at a right angle, draw the line A C, making its length equal to half the diameter of the driving pulley. Next, at the angle at which the shafts are to be set, draw the line C D; and at a right angle from this line, draw the line C E, making its length equal to half the required diameter of the other pulley. From the point, E, parallel to C D, draw the line E F, which will represent the other shaft. Now, from the point of a section of this and the line A B, draw the line G C, which will give the bevels for both pulleys.

If not above two and a half feet in diameter, the driver of the bevel pulleys may be built upon a "hub flange"—a disk of iron of about two thirds the diameter of the pulley, with a hub projecting from one side. The hub should extend half an inch beyond the thickness of the wood to receive an annular disk of smaller diameter, through which the whole may be securely bolted together.

Upon the flange, around the hub, the pulley should be built. The first two or three inches, to form the back, should be of hard wood put on radially. For the balance, use soft maple. It is, in the present state of our knowledge, the only wood that can be recommended for this form of friction gear. It should be laid on this, as upon all friction drivers, with the grain running tangentially as nearly as possible. And each subsequent course should be made smaller, so as to form the bevel. The layers are put together with glue or white lead, and carefully and thoroughly nailed. The builder should be careful to make the joints perfect, and to put the wood snugly around the hub.

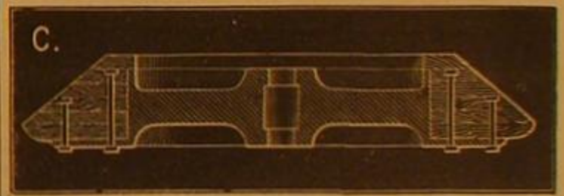
When the wood is built up to sufficient thickness, the other flange should be put on, and the whole bolted together and turned to the exact diameter and bevel required, and the pulley should be balanced with the utmost care.

For a larger bevel driver, it is best to use an iron center with arms, and a flanged rim something like a car wheel. The diameter of the rim or cylinder should be a few inches less than the smaller diameter of the face of the pulley, and that of the flange something less than the larger diameter. Upon this wheel, the wooden rim is built as directed upon the hub flange, except that the bolts must be put in as the work progresses, so that subsequent layers will cover the heads; and the pulley is finished without the smaller flange.

The diagram, marked C, shows a cross section of this pulley, which will be understood without further explanation.

In setting up this gearing, it is of the utmost importance that the countershafts line exactly to the centers of the main or line shafts, and at the precise angle for which the pulleys were fitted; and that they are substantially set, so as not to get out of line.

This gearing is thrown on and off, connected and separated, by moving the countershafts endwise in their bearings. This may be done by allowing the end of the shaft to extend through beyond the outer bearing far enough to receive an



extra box, one end of which is closed and Babbitted to receive the end pressure. This box is set up by a lever to which it is pivoted. And by having the end of the shaft grooved where it is embraced by this box, it will be drawn back where the lever is released. In light work, it is as well to make the outer bearing do the whole by making it both an end and side bearing, and having the box movable in a line with the shaft.

The pressure required, to hold these pulleys up to the work, is not great, and is easily applied by finishing the end of the shaft, and using a flat bearing of anti friction metal, the full size of the shaft. Sometimes a steel point, like a lathe center, is set against the end of the shaft to receive the pressure, but this is a very bad arrangement. It makes the bearing surface too small, and is one of the worst forms of bearing to keep supplied with oil. A flat bearing of wood, especially of hard maple, is very much better than this.

When there is considerable difference in the sizes of bevel pulleys working together, the end pressure is most upon the shaft carrying the larger, but this may frequently be neutralized, upon lines having several of these drivers, by setting them with their faces reversed.

A point that should never be lost sight of, in constructing setting levers for all friction work, is to make them adjustable so that the pressure may be easily increased if required. This is sometimes done by a ratchet with several notches, into any one of which the lever may be drawn; but it is generally better to have but one catch, and to make the adjustment elsewhere. This may be done by connecting the lever, to the part to be moved, by a rod having adjusting nuts, or by making the fulcrum adjustable by bolt or set screw.

These adjustments should be made by the person having charge of the machinery, not by the operator of each machine. They should be kept tight enough to do the work required, but more than this is a waste of power, and a useless strain upon the machinery.

It may seem unnecessary to give the diagrams of lines for the dimensions of bevel gearing, as these are well understood. But it must be remembered that we have no work on millwrighting, at present, that gives information on this point of any scientific or practical value, and that our millwrights are not all familiar with the construction of this gearing. Our mills, though superior, are built without rules or uniformity of construction.

[For the Scientific American].

PORTLAND CEMENT.

BY DR. ADOLPH OTT.

Portland cements are those artificial hydraulic mortars which are burned so that vitrification has partially taken place, and which, in this condition, contain no free lime and have a specific gravity above 3. The name originated with Joseph Aspdin in Leeds (England), in 1824. The solidified cement, having an appearance and quality equal to those of Portland stone, of which the finest edifices of the English metropolis are built, he gave to his product the name of Portland cement. When we learn that this stone is classed among the most valued building materials of England, the said designation might be considered too assuming, but it will be shown that its qualities are not overrated—in fact, that the name must be considered as very appropriate.

The Portland cement presents itself as a sharp, crystalline powder, of a color varying from light to dark gray and of a bluish or greenish tint. Chemically, it is essentially a combination of lime, silica, alumina, and oxide of iron. When mixed with water to a stiff paste, it soon solidifies into a stone of an agreeable bright gray stone color, which in its best quality attains a hardness and power of resistance equal to that of the most valued limestones, even of those of the oldest formations. Such stone, according to Major-General Gillmore, acquires during the first two years fully nine tenths of the strength and hardness which it finally attains in the course of time. Both the tensile and crushing strength vary, of course, according to the quality of the cement; but they are generally the greater the denser the mortar. The tensile strength per square inch of blocks seven days old was found by Mr. Grant to be 236 pounds for English cement powder weighing 103 pounds per U. S. bushel, while it was 406 pounds for cement weighing 126 pounds, thus showing a difference of 170 pounds per square inch. The strength of Boulogne cement for blocks, fifteen months old, was found to be by Gillmore 496 pounds. At the age of one month, according to this authority, the tensile strength of pure Portland cement is equal to about two thirds of what it attains during the first two years. With regard to the crushing strength of the cement, it does not reach its maximum limit within a period of two or perhaps three years. The crushing weight of English Portland cement was found by Grant to be, per square inch, 3,806 pounds for blocks three months old, 5,388 pounds at the age of six months, and 5,973 pounds at the age of nine months.

Cement unmixed with other material finds but a very limited application, firstly because it would be too expensive, and secondly for the fact because, though mixed with inert materials, it is yet sufficiently strong for most practical purposes. Portland cement, with three times its quantity of sand, becomes in a few months superior to mortar more than a hundred years old, while the cost of the material is reduced in no small degree.

For foundations, flooring, houses, constructions in the sea, etc., chips or small stones, gravel, broken bricks, burned clay, cinders, etc., are generally used in combination with sand. Such a mixture is then termed *béton* or concrete (from *concresco*.) The substitution of common lime for a portion of the cement results always in a sacrifice of strength in proportion to the extent of the adulteration; however, when mixed with a small quantity of lime milk, it loses proportionately but little of its solidity, while it can be worked much better and surer, as the setting is greatly retarded by such an admixture.

With regard to the durability and healthfulness of constructions of Portland cement, European experience, extending over a period of more than forty years, has established the fact that they will resist climatic influences and changes equally well as the very best building stones. Portland cement stone, if properly made, is almost impervious to water, while this cannot be said of brick and sandstone. Since warmth and moisture are peculiarly favorable to vegetable growth, these building materials are more liable to disintegration than other materials with less absorptive power. The resistance to frost is absolute, even in those buildings the roofs of which are terraced in this material. Being non-absorbent of moisture, it will not appear strange that houses built with it are from eight to ten degrees warmer in winter than houses built of brick.

Concerning the cost, 100 cubic feet of superior wall can be built, according to close estimation, for $17. This is considerably less than half the cost of construction of brick and mortar. Lintels, sills, caps, and arches can all be made at the same time and with only a slight increase of expense. The partition walls need not be eight, but four, at most five, inches being required.

By the addition of proper colors, the brown stone of New York city is imitated so accurately in Portland cement stone that the eye can scarcely detect the difference. With regard to the proportion in cost of these two stones, it may be stated that the price list of one of the companies in this city shows that the rates for ashlars, caps, corner blocks, keys, etc., range from one half to one third those usually paid in this market for blocks of cut brown stone of corresponding shapes.

For such stone, as well as for ornamental work, only fine washed sand is used as admixture for the cement.

The cost of artificial stone being so much smaller for plain work, it is evident that the difference must be much greater for ornamental work, for the cost of producing the most elaborate designs, the molds being once made, is but little more than that of the simplest blocks. When we consider that in the ornamentation of our public and private edifices there is no limit except that of design, and that duplicates of celebrated statuary can be furnished with ease, the invention of Portland cement is to sculpture and architecture what photography is to the arts of drawing and painting.

HUMAN HAIR AND ITS SUBSTITUTES.

Formerly, as ladies grew in years and their hair became thin, a false "switch" was procured, and combined with the growing hair to repair the ravages of time. Great care was taken to conceal the fact that false hair was worn, and it was only to her most intimate lady friends that the fact was whispered even.

But now all this is changed. Nineteen twentieths of all the women in the country who make any pretense to dress wear false hair or some artificial equivalent, and the lady who, no matter how luxuriant her tresses, should presume to appear in society without supplementing their natural growth with "rats," "mice," "switches," "bands," or some other specimen of the wigmaker's handiwork, would find herself so hopelessly in the minority and so laughed at by all, from her dressing maid to her most intimate friend, that resistance would be impossible, and surrender at discretion imperative.

WHERE THE HAIR COMES FROM.

The hair which adorns the heads of our belles and matrons comes mainly from the heads of the peasant women of France, Germany, and Italy. The hair buyer, supplied with sundry stores best calculated to captivate the rural eye, travels from village to village, seeking out those whose wealth of hair gives promise of a handsome price in the Paris market, the great center of the hair trade, and drives the best bargain he can in obtaining it. Sometimes the price is paid in money, but more generally in finery of various kinds, such as ribbons, cheap laces, trinkets, etc., a trade in which the buyer realizes a handsome profit both ways, and the seller parts with the adornment which Nature has provided for almost worthless ornaments which she will soon tire of and throw aside.

Having completed his purchases, the buyer takes or sends the hair he has collected to the broker, who buys it at a price which pays the buyer well for his trouble. It next goes into the hands of the merchant, under whose supervision it is cleaned with meal, sorted as to length and color, and put up in packages weighing from one to four ounces, each consisting of hairs of uniform length and color, but not all the product of any one head.

HOW HAIR IS RUINED.

Strange as it may seem, the hair which grows upon the heads of our fashionable ladies has no commercial value. Through much crimping, curling, and dosing with various hair "invigorators," "restorers," pomades, etc., it not only becomes variegated in color, but hard and brittle, rendering it wholly unfit for use in the manufacture of hair work. Indeed, it is found that the more people "take care" of their hair, the more they injure it, while those European peasants who let Nature take its course, and seldom even comb their hair, produce the finest and most delicate article.

ITS VALUE.

In the shape in which the buyer brings it in from the country, this hair is worth about $20 per pound, in gold. After it has been sorted, the different lots vary in value according to length and shade, from $1.50 to $100 per ounce. Indeed, it is almost impossible to set a limit to the outside price of choice lots of long hair of desirable shades, for so difficult are they to obtain, and so urgent is the demand from parties with whom money is a secondary consideration altogether, that the fortunate holders can set their own price and be sure of a customer. "A switch of very light gray hair," said a dealer, "thirty-six inches long and weighing five ounces, is worth $1,000, and can rarely be found at that price.

SUBSTITUTES.

In a country like ours, where fashion is a law to the poor as well as to the rich, it has been necessary to provide some cheap substitute for human hair, in order that factory and shop girls, and others of slender means, may vie with their wealthier sisters in the adornment (?) of their heads.

For this purpose, several substances are in use. The first material applied to this purpose was jute, which, after passing through several processes, is reduced to a long and glossy fiber which, in general effect, closely resembles hair, and which, owing to its comparative cheapness, rapidly came into general use. By means of dyeing, it was produced in all possible shades, and was eagerly bought in the shape of "switches," "waterfalls," etc.

ITS INJURY TO THE SKIN.

In the process of adapting jute to this use, *nicotin*, the essential principle of tobacco, and corrosive sublimate, a most deadly mercurial poison, are used. It is also rendered exceedingly brittle, and breaks as easily as spun glass. The small particles find their way through the hair to the scalp, and, their edges being ragged from the combing process, act like so many poisoned barbs, which, entering the pores and being held in place, introduce the poison beneath the skin and cause irritation and ulceration. It is owing to this that the idea became current that the jute contained animal parasites that bored into the skin and laid their eggs beneath it. The most careful examination has failed to discover any vestiges of animal life in jute, but the little barbs we have spoken of have been distinctly seen protruding from the pores of the scalp, and the sores they produce give every evidence of being the result of mercurial poison.

LINEN AND COTTON.

A more recent and harmless substitute for human hair is found in fine cotton and linen thread, dyed to the proper shade and sized to give it the requisite gloss, and then made up into the various forms in which it can be used. Switches of this material are sold at retail for about one dollar each, a price at which a very handsome profit is probably realized by the dealer.

SILK AS A SUBSTITUTE.

Probably the best substitute for human hair yet introduced is silk fiber. Its fineness and strength render it peculiarly suitable, while its brilliant luster adds to its resemblance to the real article. It is used both alone and in connection with real hair, especially in those cases where a switch just sprinkled with gray is required. To produce this effect, dark hair and gray silk fiber are taken in unequal proportions, varying according to the shade desired, and woven together, the result being with difficulty distinguished from a combination of real hair, yet costing, owing to the immense price of long gray hair, a moderate sum comparatively. Bands and braids are also made of silk, the exposed portion only being of this material, and the filling of jute or "combings."

THE EXTENT OF THE TRADE.

Formerly hair work was sold only in a few of the leading hair dressing establishments. Now large and expensive stores are devoted to its sale in the large cities, nearly every dealer in fancy articles keeps some of the grades of so called "hair goods," and in every country store neat card board boxes, containing switches, *chignons*, and other head gear, are offered for sale. So long as fashion holds its present course, every woman in the land nearly is a customer, and thus an enormous bulk of business is done, paying handsome profits to all engaged in it. At first the percentage of profit was extremely large, but competition has reduced this materially. But the volume of business has increased in a like ratio, and the sale of hair and hair work continues to be exceedingly profitable.—*Commercial Bulletin.*

Perkins' Steam Gun.

It is now more than thirty-five years since Jacob Perkins, an American, exhibited his steam gun in London, where it attracted great attention. It was shown in operation at the Adelaide Gallery, and the inventor, writing home at the time, thus describes its working, together with a curious electrical phenomenon that took place on one occasion:

"The Adelaide Gallery, of which you have frequently heard, continues to attract attention. When I first proposed the establishment of such an exhibition as that which is made there, its success was a subject of much doubt. It is now, however, firmly established. Its average number of visitants is 300 per day, each paying one shilling for admittance; on some occasions there have been 1,000; and the visitors are of the most respectable class. My steam gun showers its balls every hour from 12 to 4 o'clock. The gallery opposite to this gun is 150 feet long, and it is frequently filled, three or four deep, with intelligent spectators; and although it has been thus in use for three years, it still continues to be the lion of the day. Foreigners who visit the gallery not unfrequently avow that the object of their journey from the continent was to see this gun. On a recent occasion, just before the last volley was discharged, the atmosphere became suddenly very dark, and many were waiting to see the last shower of balls; the steam was somewhat higher than common, the gun had been recently lengthened, and from the concurrence of these circumstances the velocity of the balls was much increased, and a very remarkable effect was produced. When the balls came into contact with the cast iron target, a very brilliant group of stars was seen on the plate, each about the size of a marigold, and somewhat resembling it in appearance; light was seen also at the mouth of the gun, and the leaden balls were completely pulverized. What could have produced these effects? Was it not the result of the development of electricity by the friction, or from some uninvestigated cause?"

A Lost Art--Glass Cloth.

More than thirty years ago, M. Bonnel, of Lille, France, discovered a method of weaving cloth, out of spun glass threads, which was described as perfectly flexible and applicable to a variety of purposes, more especially the ornamentation of the walls of apartments. This fabric, the making of which seems to be at present a lost art, was described in the papers of 1837 as follows:

This cloth of glass is extremely beautiful; and, from the manner in which it reflects the light, it surpasses in brilliancy everything that has ever been attempted with silk, even when combined with gold and silver. Some specimens of this new manufacture have been exhibited in the Passage de l'Opera in Paris; and the Queen of the French was so much pleased with them, that she ordered a golden medal to be sent to the inventor. The following passage is extracted from a French paper: "When we figure to ourselves an apartment decorated with cloth of glass and resplendent with lights, we must be convinced that it will equal in brilliancy all that it is possible for the imagination to conceive; it will realise, in a word, the wonders of the enchanted palaces of the Arabian tales. The lights flashing from the polished surface of the glass, to which any color or shade may be given, will make the room have the appearance of an apartment of pearls, mother-of-pearl, or diamonds, or composed of garnets, sapphires, topazes, rubies, emeralds, amethysts, etc., or, in short, of all these precious stones united and combined in a thousand ways, and formed into stars, rosettes, bouquets, garlands, festoons, and graceful undulations, varied almost to infinity."

STUDY contentment. In these days of inordinate greed and self indulgence, keep down the accursed spirit of grasping.

BELTING AND PULLEYS.

The following interesting particulars of experiments on the capabilities of belting are by Mr. D. Hussey, published in the proceedings of the New England Cotton Manufacturers' Association of the United States:—

BELTING.—A leather strap or belt an inch wide will sustain 1,000 lbs., before breaking. Eight per cent of the breaking weight, or 80lb. to the inch, or about 400ft. to the horse power, is a tension that will not materially injure the leather, for a long period, by overstraining or stretching. This is used for single belts—main drivers only. A double belt will give one third more equally well.

Ordinarily, counter belts, where the centers are not more than 12ft. apart, will require 1,000ft. to horse power per minute, and card and loom belts from 2,000ft. to 3,000ft. to horse power per minute. When at the Nashua Co.'s mills, I ran a 20in. single belt 7,200ft. per minute, from a 14ft. diameter to a 4ft. diameter pulley, which ran successfully on the 14ft. diameter, but the centrifugal force on the 4ft. diameter pulley caused it to jump or fly from the surface and run a little uneven, owing to the uneven weight and thickness of the leather.

I think it would have run well on a 6ft. diameter pulley. When it was running 6,000ft. per minute, it ran very satisfactorily indeed. From this experiment, I have come to the conclusion that 6,000ft. is as fast as a belt should run when the pulley is not over 4ft. diameter. Taking this as a basis of calculation, a 10ft. pulley may run a belt 10,000ft. per minute with safety. It is, however, seldom in practice that we should use such quick speed. Some three weeks since I commenced running a single belt 5,400ft. per minute, the smaller pulley being about 4ft. diameter, which gives excellent satisfaction. I know of no definite rule for running belting; everything depends upon surrounding circumstances.

A horizontal belt, running on not less than a 7ft. diameter pulley, 50ft. from center to center, and working side at bottom, will run well with 400ft. to a horse power, the slack being taken up by its own weight. The same belt, at an angle of 45°, will require 5,000ft. to the horse power, and with a vertical belt it will be almost impossible to run it any length of time without a binder (which of all things we dread in a mill). I will now mention one law of belting that may not be known to you all—that is, the hug or adhesion is as the square of the number of degrees which it covers on the pulley, or, in other words, a belt that covers two thirds of the circumference of a pulley, requires four times the power to make it slip as it does when it covers one third of the same pulley.

Belts, like gears, have a pitch line, or a circumference of uniform motion. This circumference is within the thickness of the belt, and must be considered, if pulleys differ much in diameter and you must get a required speed.

Owing to the slip, elasticity and thickness of the belt, the circumference of the driven seldom runs as fast as the driver. With two pulleys of equal diameters, one may be made to run twice as fast as the other without slipping, if you use an elastic belt of india rubber.

I simply mention this to show the effect of elasticity in belts. As the power of a belt is as its velocity, it is well to run it as fast as possible, to avoid lateral pressure and consequently friction of the shaft.

PULLEYS.—One of the greatest objections to the fast running of shafting and belts is the want of pulleys properly constructed. My experience leads me to the conclusion that it is not safe to run a cast iron pulley, 4ft. diameter, 400 revolutions per minute, owing to the unequal shrinkage of castings in cooling and other imperfections. Running slow, the centrifugal force has but little effect; but as the centrifugal force is as the square of the velocity, it is not so easily overcome in rapid motions.

If you make the rim of the pulley thicker, the centrifugal force increases with the thickness, and consequently nothing is gained by the extra iron. I have, therefore, substituted white pine felloes made of one inch boards, breaking joints for the rim, built on cast iron hubs and arms. The centrifugal force of material is as the specific gravity, and the specific gravity of cast iron is thirteen times that of pine, hence the centrifugal force must be thirteen times greater; but the tensile strength of cast iron is only two to one of that of pine, therefore the rim of a pulley made of white pine felloes will sustain from four to six times the centrifugal force of a rim made of cast iron, that is, the same diameter with white pine felloes will run more than double the velocity without being torn asunder. It is less likely to be broken by jar or blow, and is less than half the weight, and of course takes less power to run it. I have run a pulley made in this way, 16ft. diameter, 4ft. wide, 90 revolutions per minute for 18 months. I have just started another, 17ft. diameter, 62in. wide, 100 revolutions per minute, driving on to one made the same way, 4ft. diameter and running 425 revolutions per minute. Both of these are working well. I am fully convinced that, with quick shafting, wood must take the place of cast iron for the rims of pulleys 3ft. diameter and above.

No. 2 section of Lawrence Manufacturing Co. has been running with gears, shafting, pulleys and belts, conforming as nearly as possibly to the above rules, and is driving the shafting for 38,000 spindles (throstle, ring, and mule,) with the same amount of power as it formerly required for 19,000 spindles

IT cannot be too deeply impressed upon the mind that application is the price to be paid for mental acquisitions, and that it is as absurd to expect them without it as it is to hope for a harvest where we have not sown the seed.

The Chili Saltpeter Deposits of Peru.

In travelling eastward through Peru, from the sea to the Cordilleras, on the 20th parallel of south latitude, seven zones are crossed, the third of which, the Pampa of Tamarugal, and the fifth, Serrania Alta, or the inner chain, (Upper Peru, or Bolivia) are explored for saltpeter. The treeless Pampa, a plain somewhat depressed in the center, has a very scanty vegetation, and the only thing which grows there is a single variety of lucerne grass (*mendicago*); the cultivation of even this is attended with difficulty, on account of the large proportion of common salt, borax and saltpeter in the soil. It serves in part for the support of the beasts of burden used for transporting to the coast the salts and metallic minerals found here. In the south of the Pampa is a large deposit of borax, pieces of which weigh on an average from 100 to 200 grammes; soda saltpeter is found on the borders of Pampa and Serrania, but too far distant from the sea. On the western slope of the Cordilleras, salt is only found in small quantities; but in Upper Peru, where frequent rains wash it together into great lakes, there are large quantities of it. The saltpeter mines consist of different strata. The surface of the ground is composed of silicates, sandstone and pieces of lime. At a depth of from 8 to 16 inches, very regular prisms are usually found, which sparkle with a mass of very small microscopic crystals; the strata below this, which is of rocky hardness, consists principally of common salt, with a little chloride of potassium and soda saltpeter, mixed with earth and pieces of silicates and carbonates, and has a thickness of 20 to 25 inches. Beneath this crust is the pure soda saltpeter, in more or less perfect crystals, from 20 to 40 inches long, and 3 to 7 feet in diameter. Guano is seldom found there, and only in small quantities; and it always occurs just below a stratum of salt. It is not in a powder, like that from the Chincha Islands, but adheres together, and is of a a brown color, containing the bones and remains of birds and insects, and has an ammoniacal smell.

The chloride of sodium and lime present furnish mineral constituents required for the formation of the saltpeter. According to Thiercelin, the guano furnishes the nitrogen; but since the guano is always found below the salt crust, Kœnig is compelled to refer the nitrogen to some other nitrogenous organic bodies, from whose decomposition ammonia is formed, and this in turn is converted by the action of the air and organic bases into nitric acid. Besides the three substances named, all the conditions favorable to the formation of saltpeter are found in that neighborhood, namely, a pure dry atmosphere, absence of rain to wash away the saltpeter when formed, and the regular night fogs. The latter, leaving the salt undissolved, dissolve the saltpeter and filter it through this stratum, under which it crystallizes.

The search for saltpeter is conducted thus: The workman recognizes its presence by certain undulatory elevations of the ground, and numerous lumps of lime and disintegrated sandstone. He bores a hole some 12 to 18 inches in diameter, going down till the mineral is plainly visible. When the lowest layer is reached, the hole is widened to about three feet, filled with charcoal and sulphur and fired. The explosion breaks and tears up the ground for twice that distance around, and then properly begins the bringing up of saltpeter. The crude article varies considerably in compactness, color and quality and is named accordingly. The so called sulphuret, which owes its name to its mode of manufacture, is the purest. The porous, earthy and the congealed are different in quality. If the raw product contains less than 50 per cent, the mine is abandoned as not worth working; a yield of 70 to 80 per cent is exceptionally good. The raw material is transported on pack animals or wagons to the factory, where it is refined in two different ways. One method is to break it up in pieces and put it in an iron kettle half full of water, which is then heated over fire for an hour, the insoluble matter removed and a fresh quantity of raw material added until the solution is saturated. The clear solution is run off into crystallizing vessels, the crystals collected when formed and allowed to dry in the sacks in which it is shipped. In the second method, steam heat is employed; the crude material is put in perforated iron baskets and suspended in boiling water, and the process repeated until the liquor is saturated. The saltpeter prepared in this way contains less than one per cent of common salt, while that obtained by the former method contains upward of two per cent. Large quantities of iodine are annually reclaimed from the mother liquors of the saltpeter works of South America.

Xylol as a Remedy for Small Pox.

Xylol, called also xylene and dimethyl benzole, is one of the coal tar products analogous to benzole and toluol. It was first found by Cahours, among the oils which are separated from crude wood spirit by the action of water, hence its name from the Greek word *xulon*, wood; its formula is $C_8 H_{10}$. The series is: Benzole, $C_6 H_6$; toluol, $C_7 H_8$; xylol, $C_8 H_{10}$.

Xylol has been accurately investigated by Dr. Hugo Muller, who prepared it from coal naphtha, by fractional distillation until a distilate was obtained having the specific gravity of ·866, and a boiling point of 140° C. This distilate is mixed with sulphuric acid, which dissolves the xylol, and forms xylol sulphuric acid; this acid is decomposed by dry distilation, and the xylol thus obtained is further purified. It is colorless, has a faint odor somewhat like benzole, but different in boiling point and specific gravity.

Xylol appears likely to become of great importance, if its application in cases of small pox is really followed by such good results as have been reported from Berlin. It should be given in the early stages, whenever the physician has reason to anticipate small pox. Ten to fifteen drops a day may be used as a safeguard in addition to vaccination. It is presumed to destroy the poison in the blood. Raspberry sirup covers the taste and forms an eligible method for administering it, particularly to children. The dose is three to five drops for children, ten to fifteen drops for adults, every hour to every three hours. A teaspoonful at a time has been taken without injurious effects. It is necessary to proceed with caution, as its specific action is not closely defined and must be made the subject of research.—*Journal of Applied Chemistry.*

Wilkinson's Machines for Cleaning and Finishing Carpets.

Mr. John Wilkinson Jr., a carpet manufacturer of Leeds, England, has recently patented, through the Scientific American Patent Agency, improvements in the process of and machinery for cleaning and finishing carpet fabrics. The invention relates to that class of carpet fabrics in which the pattern is produced by printing after the fabric is made. It is well known that the colors used for printing these fabrics are mixed with earthy and vegetable matters so as to make them of a proper consistence for printing from blocks or rollers.

When the printing has been completed (and the colors have been fixed by steaming the fabric), the earthy and other matters are usually removed by washing the carpet in water. It has been found that, when dark colors are used in the printing operation, this washing process is very liable to (and, in fact, almost invariably does) injure the brilliancy of the lighter colors, and also discolors the white ground.

The object of Mr. Wilkinson's invention is to dispense with the washing, and to remove the earthy matters from the fabric by a totally different process. To this end, when the fabric has been printed and steamed in the usual way, it is taken to a drying room and thoroughly dried, so as to render the earthy and other matters brittle and easily detachable from the textile fibers of the fabric by means of friction.

The mechanical appliances, found most convenient for the purpose of detaching the earthy matters from the fibers, consist principally of a series of blunt knife edges or scrapers, which may be secured either in a reciprocating frame or frames so that they may be dragged to and fro in contact with the printed surface of the fabric, to break up the earthy and other matters and detach them from the fibers as the fabric is being carried slowly through the machine: or these knife edges or scrapers may be adapted to the peripheries of cylinders or rollers, which may be made to rotate, at a suitable speed, and scrape the fabric as it is being drawn forward by drawing rollers or other equivalent appliances or devices. This latter is the arrangement of mechanism preferred.

A Very Good Compost.

A gentleman residing at La Grange, Ga., wrote to us, some time since, that the following mixture had been used upon the cotton fields of that section with excellent results:—

Nitrate of soda	40 lbs.
Sulphate of ammonia	60 "
Muriate of potash	20 "
Bone dust	200 "
Gypsum	200 "
Salt	50 "
Soil or muck	1,430 "
	2,000 lbs

This mixture embraces quite all the great essentials of plant food, but we think it is too much attenuated. The proportions might be doubled (leaving out half the soil) with advantage, as it would not be so heavy to handle, We would, however, suggest an improvement in the proportions employed: instead of 60 lbs. of sulphate of ammonia, it had better be, for cotton, 100 lbs.; and good, true superphosphate might take the place of the bone dust with advantage. The cotton plant needs the active influence of phosphoric acid to push it forward vigorously. If the planters will combine together and purchase these commercial articles, good and true, at the lowest wholesale rates, and make this compost, they will save the tens of thousands of dollars thrown away upon the factitious mixtures sold so freely in the South.—*Boston Journal of Chemistry.*

WE mentioned some months ago that a member of the Odontological Society had succeeded in replanting teeth which had been extracted in consequence of disease. To the process by which this was accomplished, he gave the name of *Reimplantation.* Another member of the same Society has now had the operation tried on himself, and with success. The tooth, which had for some time been painfully affected by changes of temperature, was carefully pulled out, to prevent straining or tearing of the gum; the dental canal was cleansed, the decayed part was scraped from the crown, and stopping applied in the usual way, and then the tooth was replaced in its socket. The operation lasted about half an hour: for three or four hours there was a dull aching pain, which, however, entirely ceased before noon of the following day, though some tenderness remained. This in turn disappeared; and by the end of a fortnight, the replanted tooth did without difficulty all the duty which a tooth is expected to do. From this it will be understood that a tooth slightly diseased at the root need not be thrown away, and that persons who object to an artificial tooth may with proper care retain the teeth which Nature gave them.

REFINED nickel is worth $3 a pound. The ore is found in Pennsylvania and Missouri. The Pennsylvania mines furnish the principal supply at present, and are said to be very profitable.

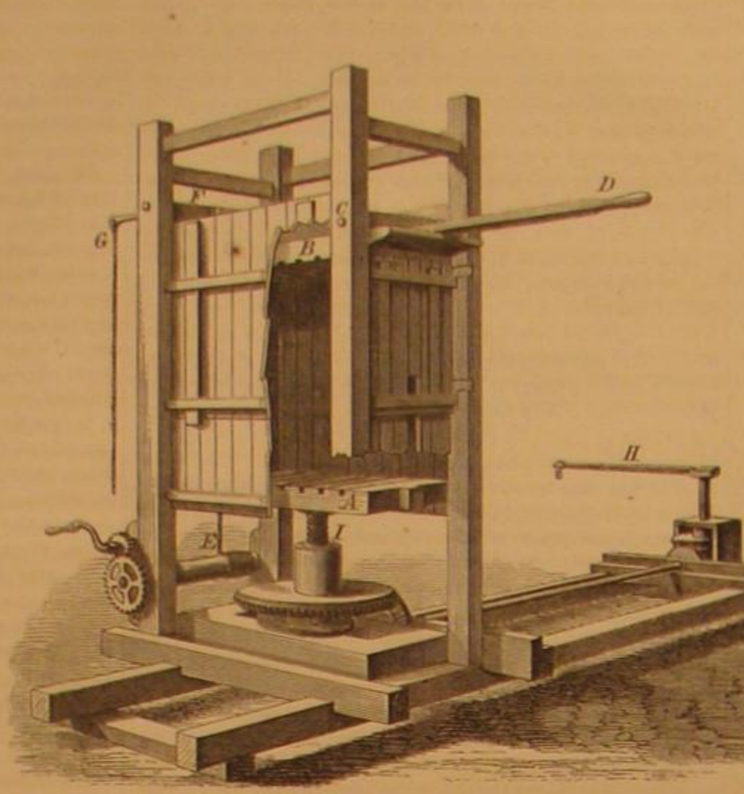
Improved Baling Press.

The peculiarities of this press are that an auxiliary follower is hinged to one side of the part of the press into which the loose material is filled, which, in closing rapidly, compresses the material to a certain extent, when, being supported in a manner described below, more powerful pressure is applied to the opposite follower, by which means the bale is consolidated as much as desired.

A, in the engraving, is the principal follower, and B the auxiliary follower, pivoted to the case at C. This follower is thrown open on its pivots by means of the lever, D, and is forced down by means of the windlass and rope, E. When thus closed, it is fastened by a pivoted section, F, of the side of the case, actuated by the lever, G, and rope, which section swings down and engages the edge of the follower. When the press is thus closed, horse or other power is applied to the lever, H, which, through a system of shafting and gearing, actuates the screw, J, forcing up the principal follower and finishing the compression of the bale.

This construction will facilitate the compression of hay, cotton, wool, and other loose and bulky substances which, in ordinary presses, require nearly as much time to reduce them in volume sufficiently to apply great power advantageously as to complete the compression. The improvement has the further advantage that it does not make the press bulky or unwieldy, and adds little to the cost of manufacture.

Application pending through the Scientific American Patent Agency. Address, for further particulars, John Myers' Sons, Washington, N. C.



MYERS' IMPROVED PRESS.

Improved Hot Air Furnace.

Our engraving represents a hot air furnace, which, through the extent of heating surface secured in its construction, obviates the necessity of overheating the plates in cold weather in order to obtain the requisite heat in the apartments to be warmed, thus preventing the burning of the organic matter, floating in the air and so far vitiating the latter. This is a common fault of hot air furnaces, and may often be detected in the faint oppressive smell imparted to the air which has been overheated. Provision is also made in this furnace for more perfect combustion than is usually obtained in apparatus of this kind. By a peculiar automatic device, the heat is made self-regulating, as will appear in the following description.

Cold air enters at A, passes up through the annular space between the outer shell, B, and fire box, C, and, circulating through the heating tubes, D, is led from the top of the furnace, wherever desired, through suitable pipes or flues. The gases of combustion, rising from the fire box, are reverberated in the gas deflector, E, consisting of a double cylinder, the inner one being closed at the top, and having a perforated bottom to which air passes through the tube, F, to complete the combustion of the gases. Thence the heated gases pass up into the cylinder, G, which is closed at the top but has an opening in the side, shown at H, whence the gases issue and circulate about the outer surfaces of the heating tubes, finally passing out into the smoke pipe on the opposite side of the furnace from that shown.

A prominent feature of the furnace is the damper regulator. I is the draft tube, admitting air to the fire box through the opening, J, this opening being controlled by the valve, K, automatically operated by the expanding rods, L and M, the rocking bar, N, and the levers, O and P. The rod, L, has one end permanently fixed at Q. The other end is pivoted to the rock bar, N. As it expands by the action of heat, it raises the end of the rock bar to which it is pivoted and depresses the opposite end. This moves the bar, M, downward, this rod also expanding by heat so that the combined movement of expansion is communicated to the levers, O and P, and increased by the latter so as to close the valve, K, more or less, according as the heat increases. By means of the sliding rod, R, the lower end of the rod, M, is moved nearer to or farther from the fulcrum of the lever, O, to regulate the degree of opening or closing of the valve, K.

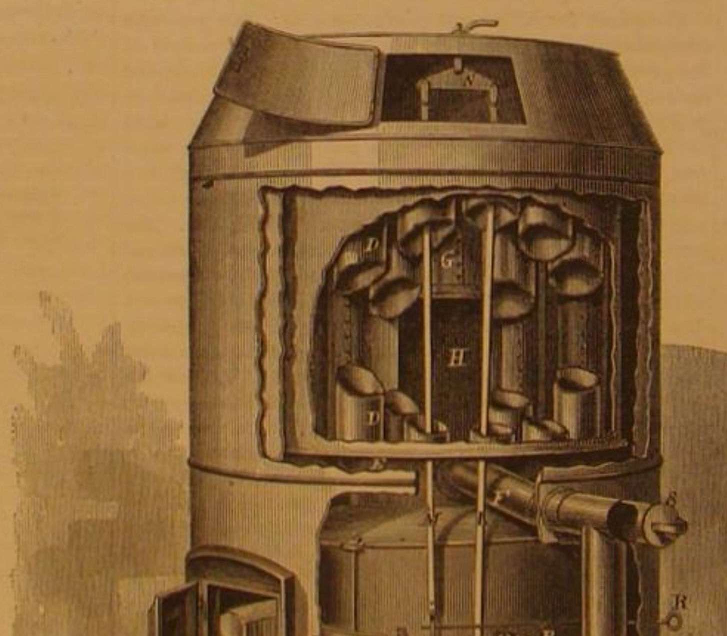
The tube, F is supplied with a damper, S, by which the inflow of air to the gas deflector is regulated.

In burning wood, the gas deflector, E, performs another office from that above described. Besides completing the combustion, it so mingles air with the watery vapors as to prevent their subsequent condensation and dripping in the pipes, when the combustion proceeds slowly. Those who have experienced the annoyances, caused by such condensation and dripping in the use of hot air furnaces, will appreciate the importance of an improvement which removes these nconveniences.

The furnace does not need to be inclosed by masonry; a slight excavation in the earth bottom of a cellar is made to receive a foundation of bricks laid without mortar. The fresh cold air is led in from the outside of the building through a board flue, and the setting may be done quickly and cheaply. In case the cellar has a brick or cement bottom, no excavation will be required. The radiating pipes are of sheet iron, and therefore radiate their heat to the passing currents of air with rapidity. A suitable water pan for regulating the hygrometric condition of the heated air is provided.

The heater can be used where a cast iron heater would take up too much room. By setting the dampers properly, it is claimed the fire can be kept smoldering for forty-eight hours. It is further claimed that the furnace is made with air tight joints, so that leakage of gas is impossible. It requires but slight attendance, and seems a very perfectly contrived apparatus for the purpose of heating buildings.

For further information address Holcomb & Gould, of Painesville, Ohio, in whom the patents on the original furnace and recent improvements are now vested.



HOLCOMB'S HOT AIR FURNACE.

The manufacture of hoop iron is fast getting to be a speciality, limited to those who make no other kind of iron, roll trains being adapted in speed and constructed with a view solely to this purpose. The rolls are turned so that the iron can be rapidly reduced and greater quantity produced with better finish, while very strict attention is given to the selection of metals for mixture.

The fourth Atlantic telegraph cable is now being made by the French Transatlantic Telegraph Company, and is to be laid between the coast of Massachusetts and France in 1873. Three Atlantic cables are now in operation, two *vià* Ireland and one *vià* France.

Maple Sugar.

Nearly all our hard wood trees will yield more or less sugar but only a very few of them furnish it in large quantities or pure enough for domestic use. The *Acer* or maple family stands at the head of the list in this respect, and chief among these is the *Acer saccharinum* or sugar maple, the juice of which contains from three to six per cent of cane sugar. That which comes from the tree when it is first tapped is much richer than that which flows later in the season. The first sap ascending the stem naturally dissolves out the largest proportion of the starch and gum.

After the sap is drawn, it is concentrated by boiling until it commences to crystalize, when it is allowed to cool and deposit the sugar. During this concentration of the sap, the lime salts which have been held in solution are gradually precipitated as the sirup becomes more dense. This deposit, or "niter," as it is called consists, according to some authorities, of carbonate of lime; others consider it to be malate of lime or saccharate of lime.

The flow of sap varies much with the state of the weather, being most abundant when the nights are cool and the days warm. This has been explained on the supposition that on warm days the air contained in the trunk of the tree expands, thus forcing the sap out; while as the tree cools off at night the air contracts, and the sap rises from the roots to supply the vacuum, to be again forced out the next day. As soon as the leaves commence to expand the flow ceases, because then the leaves are able to evaporate all the water that the roots can supply. But the continual tapping of the tree and the withdrawal of its stores of nourishment soon cause it to languish, and it cannot survive such treatment many years any more than a man could survive the loss of a considerable portion of blood each day.

Telegraphing at Sea.

Captain Columb, R. N., in a paper recently read before the Society of Telegraph Engineers, London, said:—

Telegraphing at sea by night was confined to a very few set messages, represented by white lights displayed in different numbers and forms; this was continued until twelve years ago, when what is now called the "flashing system" was introduced, which has since been completely adopted in the English navy and army. This is nothing more than the adoption of the "dot and dash" of Morse, or the "long and short flash," as they are now called, to universal application.

It was shown how, by the long and short display of a single light, the long and short wave of a flag, the long and short appearance of any object, or the long and short sound on a horn or steam whistle, all the present wants of telegraphing at sea were supplied.

The paper was illustrated by various diagrams and specimens of apparatus actually in use, one of the most important being a flashing light, known as the Chatham light, of great power and simplicity, the light being produced by jets of diluted magnesium powder into the flame of a spirit.

It was shown that all telegraphy was reducible to a system of visible or audible signs following in certain succession. The means of distinction in visible signs were difference of form, color, and motion; in audible signs, differences of tone and motion (or time), while semaphores represented form, and flags, color and form; the most powerful distinction of all, motion, was more practically employed until the flashing system made its appearance, and it not only threw open the hours of darkness to the purposes of telegraphy at sea, but it made the transmission of messages more rapid, while enormously extending their range. Instances were given of messages sent thirty miles from mid channel to the coast of England at night, and of messages read by the naked eye in the day time, when flags could not be read with the most powerful telescope.

Javelle Water.

Old engravings, wood cuts, and all kinds of printed matter, that has turned yellow, are completely restored by being immersed in this preparation for only one minute, without the least injury to the paper, if the precaution is taken to thoroughly wash the article in water containing a little hyposulphite of soda. Undyed linen and cotton goods of all kinds, however soiled or dirty, are rendered snowy white in a very short time by merely placing them in the liquid mentioned. For the preparation of Javelle water, take four pounds of bicarbonate of soda, one pound of chloride of lime; put the soda into a kettle over the fire, add one gallon of boiling water, let it boil from ten to fifteen minutes, then stir in the chloride of lime, avoiding lumps. When cold, the liquid can be kept in a jug ready for use.

To allow the clothing to dry upon you, unless by keeping up a vigorous exercise until you are thoroughly dried, is suicidal.

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Contents:

(Illustrated articles are marked with an asterisk.)

DOUBLE PLOWS.

Considerable attention has been recently given in England to the use of double plows, the advantages gained being claimed to be considerable as compared with those of single plows. As inventors are ever on the alert to improve agricultural implements, it may not be amiss to place before them some facts connected with this subject, from which they may possibly derive useful hints.

The idea of using double plows is not new. In a lecture delivered before the Framlingham Farmers' Club (England), Mr. J. E. Ransome stated that he had found in a book entitled "England's Improvement," written by Captain Walter Blith in the time of Cromwell, the first account of such a plow. In Arthur Young's "Tour to the North," published in 1771, is also found the account of a double plow fitted with two wheels, then in use in Worcestershire; this plow was afterwards improved by Mr. Berney, of Bracon Ash, Norfolk. Mr. Ransome referred to the plow patented by Lord Somerville in 1802, and also to the first adjustable double plow made by a Leicestershire plow wright, Mr. Handford, of Hathern; and to show what was actually accomplished at that early date with double furrow plows, he quoted from an article on the subject, given in Rees's "Encyclopædia," in which it is stated that at a trial which took place on the Royal farm at Windsor, 17½ acres of unstirred land were plowed with four Devon oxen, one man and a boy, in six days and a few hours, and that the oxen were in better condition after the trial than at the beginning. This is close upon 3 acres a day, which Mr. Ransome thought was not bad work. In the same article, a letter from an Essex farmer occurred, in which it was stated that Lord Somerville's double plow effected a saving of 5s. a day while in use. Various trials of double plows were conducted by the Bath and West of England Agricultural Society at the beginning of this century, and so thoroughly did they then consider it a standard implement that it was engraved at the head of their printed forms used when giving diplomas in connection with the Society.

Various reasons may be assigned why, notwithstanding these attempts, the single plows still retained their supremacy in popular esteem. They were lighter, easier to handle, and did not require so much power to draw them; while the double plows were so constructed as not to offer the advantages claimed for the new double plow known as the Pirie plow, and improved by the Messrs. Fowler, of Leeds. This plow may be described as follows:

It consists of two plow bodies, carried on a wrought iron frame work, entirely supported on wheels, two of which run in the furrows, one in front, the other behind, and a third wheel runs on the land a considerable distance from the furrow, about midway between the other two, so that the plow is supported on three points at the corners of a triangle. The leading furrow wheel is steered by a lever leading to the back part of the plow, and handles are dispensed with. The plow is turned at the headlands by depressing the land wheel and steering the leading furrow wheel. An improvement made by Mr. Jeffries enables the plow to be lifted bodily, its weight resting upon two wheels in turning the headlands.

Instead of the ordinary slade or land slide, these plows are each fitted with a friction wheel which runs along the cut edge of the plowed land and greatly reduces the friction. In this way, a saving of fifty per cent of the power is claimed to be made in moist land, in which the friction against the slade is very great. In very dry clay land, the saving is not so great. It is maintained that in moist land a team of horses will do one third more plowing per day, with the same labor, with this plow than with the ordinary single plow, a claim which challenges attention and which, if demonstrated to be founded in fact, ought to revolutionize the present system of plowing. We are not prepared to admit so much, but there are still other advantages worthy of consideration. The double plow is as easily managed by one man as the single plow, so that if three or four horses were required to draw the former, the wages of one plowman would still be saved. It is also claimed that the work is done better, the plow working steadily and turning its furrows better than the single plow. The pan or furrow will evidently not be so much trodden if two horses can do the work of three. The bottom and the land side of the furrow are not glazed by the friction of the bottom and slade, as with ordinary plows. The double plow is also claimed to possess peculiar advantages for subsoiling and hillside plowing. Without conceding all these claims, they are sufficient to awaken thought, and perhaps to suggest some improvements upon the present system of plowing in this country, which constitutes so large a portion of agricultural labor. To reduce this one third is a result worthy the efforts of any inventor, and one that would bring a sure reward.

THE UTILIZATION OF WATER IN ITS RELATION TO PUBLIC HEALTH.

It is needless to say that in regions the products of which are largely increased in value by manufacturing them into articles of utility or luxury, the possession of unlimited water power is an advantage scarcely to be overrated. Yet it seems undeniable that the utilization of water power is attended with certain disadvantages. The latter, while not sufficient to induce the public to neglect such natural resources, are still of enough importance to render their possible diminution a subject of consideration.

Our attention has been specially called to this by an article on mill dams and other water obstructions, and their relations to public health, published in the report of the Massachusetts Board of Health.

This article, prepared by Mr. George Derby, the Secretary of the Board, contains many interesting facts, some of which we must pass over entirely, but one of which is of great significance. This is stated as follows:

"There is reason to believe that the territorial line of division (always ill defined) between fevers of a continued and of a periodic type is extending northward, and that our immunity from remittents and intermittents is far less complete than in previous generations. Thirty-four years ago, Dr. Oliver Wendell Holmes instituted an inquiry, among the most experienced physicians of the time in New England, with the purpose of learning what they themselves knew and whatever had come down from their predecessors concerning intermittent fever originating within the field of their practice. The materials thus collected were made the basis of an essay of singular interest, which was published in 1838 as a Boylston prize dissertation. It appeared from all the evidence collected by Dr. Holmes that the traces of indigenous intermittents in Massachusetts were, except in a very few places, but scanty.

About the year 1828, a dam was built for obtaining water power for mechanical purposes on the Housatonic, two or three miles south of the Massachusetts line. It affected the hight of water on that sluggish stream for a distance of ten miles, and was followed by such increase of intermittent fever that the people sought and obtained legal authority for the removal of the dam on the ground that its effects on public health were such as to constitute it a public nuisance.

Twenty-five years ago, it was taught in our medical schools that intermittent fever was a disease almost unknown in Massachusetts, except when contracted in other places.

The exemption of the people of this State from periodic fever seems to be far less complete at the present time."

The gradual enlargement of the area of malarious influence from the latitude of Long Island toward the southern border of Massachusetts is a fact, to which earnest attention is called. There have been during the past eight years, as near as can be estimated, 6,700 cases of periodic fevers in and about New Haven, Conn. According to Dr. E. W. Blake, who furnishes these statistics, these cases "have been of every form and type, regular, irregular and defective; the latter covering cases of dumb ague which are very common in the old fever and ague localities. Cases of remittent have also been quite numerous. In many localities, whole families have been prostrated with the various forms of this malarious disease; old and young have alike suffered. There have been instances of the closing of factories by their proprietors from this cause."

While this increase of malarial disease is not attributed by Mr. Derby entirely to the increase of mill dams and other water obstructions, there can be no doubt that these are in many cases fruitful sources of fevers. Tide mills in crowded neighborhoods are particularly named as objectionable in this respect. Probably any of our readers are cognizant of many dams in which the water becomes stagnant and offensive in hot weather. Such are undoubtedly productive of disease. The tide mills mentioned have, it is stated, not been found profitable, but their dams remain to poison the air and injure the general health. All along the Massachusetts coast are to be found old dams likely to become similar nuisances.

No dam ought ever to be abandoned and left undrained; yet these may be met with in many parts of the country, stagnant pestiferous pools of corruption.

While there can be no doubt that water obstructions tend to promote fevers of various types, we believe that other causes have a more direct relation to the increase of malarious disease in the New England States. There has been, in these States, an enormous reduction of standing timber during the past decade. Wood working of all kinds has been making inroads upon the wooded districts, scarcely credible except to those who are well acquainted with the magnitude of this class of manufactures. The depletion of the timber sets in motion a train of causes which has been well recognized as a fruitful source of malaria in new countries. The increased evaporation of water, through the action of heat upon the newly exposed soil covered with decaying vegetable matter, at once engenders malaria, while the lessened flow of water in the streams exposes marshes and bogs, previously covered with water, and the moist stagnant mud thus denuded ferments and pours forth streams of fetid and poisonous gases and vapors. It is well known that of late the streams in Massachusetts and Connecticut have run very low in the summer season, leaving, in many places, wide flats of ooze directly exposed to solar heat.

It has been well said that civilization has its penalties, and this spread of malaria is probably unavoidable. Certain compensations will take place in time. Bogs will gradually fill up and become drier. The newly cleaned lands will gradually cease to emanate malaria, and the country will probably resume its original healthy condition.

In building dams, much might be done to prevent their ill effect upon the general health. The construction of cheap dykes will often prevent the shallow overflow of acres of ground without materially limiting the useful capacity of the dams. In many instances, the value of the land reclaimed would more than pay the cost of the dykes. This method of protection could undoubtedly be enforced, without oppressive restrictions and to great advantage. In building dams, a little plowing and scraping will also often change the contour of the surface so as to obviate shallow margins without at all lessening the amount of water the dams will hold. In short, there are few instances where a little cost and pains might not remove the objectionable features of dams as many of them are now constructed.

The report of the Massachusetts State Health Board is full of interesting information, but we have not space to review it more extensively. We close with its following extract:

If the cycle of malarious influence should again come round, if intermittents and remittents should prevail in Massachusetts as they do now in Connecticut, they need not be looked for on the dry pine plains or on the hillsides, but will surely be found by the sluggish water courses, in the salt water marshes, by the side of obstructed streams and reservoirs, and wherever the natural flow of water is so hindered by man's contrivances that the result is stagnation.

THE AIR FILTER.

Professor Tyndall, after a long series of experiments with atmospheric air, concluded that many of our most formidable diseases, such, for example, as small pox, cholera, and typhoid were propagated by the flotation of invisible particles in the atmosphere, and that, by the use of a suitable breath filter, it would be practicable for any person to enter an infected apartment without danger. The same apparatus, he stated, might be used by firemen, enabling them to enter buildings filled with dense smoke without injury, as the filter would arrest the particles of carbon, of which smoke is composed, allowing only the air to pass into the lungs. A further use of the breath filter is to facilitate miners in exploring and working in mines where carbonic acid gas is present in noxious proportions.

A recent trial of filters, made substantially as suggested by Professor Tyndall, has lately taken place in England, and we will describe some of the results. The filter itself consists of a cylinder, four or five inches long and two inches or more in diameter. Its interior contains, at the top, a layer of cotton wool which has been moistened with glycerin, then a layer of dry cotton wool, then a layer of charcoal, then cotton wool, with wire gauze covers at both ends, and at the upper end a mouth piece so shaped as to fit closely over the mouth of the wearer. By drawing the breath through this instrument, the most dense smoke may be entered with impunity. This filter has been tested by the London Fire Department with such success that the firemen of that city are to be provided with it for regular use. When places are to be entered, such as mines or wells, where carbonic acid gas is present, it is necessary to add another layer of cotton wool, and to place a layer of slaked lime between the two bottom layers of cotton. The object of the lime is to arrest the carbonic acid and oxide gases.

A recent test consisted in placing the experimenter, who had one of the instruments secured over his mouth, within a small closet, with a rabbit and two birds for companions. Carbonic acid gas and carbonic oxide were then injected until the atmosphere of the closet was rendered highly poisonous. In 23 minutes, the animals were dead, but the experimenter came out at the end of 30 minutes, having suffered no inconvenience from the noxious gases; but the work of breathing through the small instrument for so long a period and the heat of so small an apartment rendered him uncomfortable. Experiments are still in progress to determine the best sizes and forms for the instrument, and ere long we may expect that the air filter will be an instrument of common use.

THE shortening of puddling furnaces, by leaving out the neck almost entirely, is now being done after trial by some mills. The improvement contracts the entire furnace about thirty inches. The fire chamber and working chamber are the same as usual. Some half dozen of the Pittsburgh mills have adopted the change; the saving is obvious.

FOLDING CHAIR, LOUNGE, AND BED.

Mr. Henry James, of North Adams, Mass., has recently patented, through the Scientific American Patent Agency, a folding and extension chair, which has many points of utility worthy of special mention. Its first office is that of an easy chair, in which capacity it is really luxurious, being capable of any style of comfortable and ornamental upholstering, which may be desired, as well as of being upholstered as cheaply as any other chairs in market. Very simple adjustments convert it successively into an invalid's lounging chair, child's crib, a complete iron bed, an ottoman or table, in all of which capacities it is a serviceable and comely piece of furniture. For those occupying small furnished apartments, nothing could be more admirably adapted, as it economizes the room usually occupied by a bed, besides doing duty through the day as an easy or lounging chair. For druggists' clerks and night clerks who sleep in stores, it will also prove serviceable, as besides the merit of utility, it has that of cheapness. The frame work, being of iron, does not harbor vermin, and is very strong; and being placed upon castors, it is easy to handle.

PHOTOGRAPHIC TOILET AND HAT RACK.

A unique and ornamental design for a hat rack has been devised by Mr. William McEntyre, of North East (Erie Co.), Pennsylvania. It consists of a hat rack, which can either be suspended from the side of a wall or supplied with a suitable stand. In the center is a circular or oval mirror. At the sides are brackets for the support of vases or toilet bottles. But the most novel feature of the design is that each of the pegs or supports for hats, coats, etc., has a place provided in the end, for the reception of a circular photograph, about two and one half inches in diameter. A family picture gallery may thus be placed in the rack, or the vacancies may be supplied with views of public places or other objects of interest.

Mr. Josiah Partridge, of 368 Pearl street, is the sole agent for New York.

ON THE REASONS WHICH HAVE CAUSED THE ADOPTION OF THE NEW ATOMIC WEIGHTS.

We mentioned, at the close of an article on the modern status of organic chemistry, in a former number (page 232), that there were different reasons for the adoption of new chemical equivalents, or rather for the correction of many of the thus far accepted atomic weights. We will now explain one of these reasons.

Gay Lussac discovered the law that the ratio in which gases and vapors combine by volume is always a very simple one, and that the volume of the resulting gaseous product bears also a simple ratio to the original volumes. So one volume of oxygen will combine with two volumes of hydrogen, and condense to two volumes of water vapor; one volume of chlorine will combine with one volume of hydrogen, and form two volumes of hydrochloric acid gas; one volume of nitrogen will combine with three volumes of hydrogen, and condense to exactly two volumes of ammonia gas, etc. It is seen that the compound has sometimes a volume equal to the sum of the component gases, and sometimes is condensed to a less bulk; but this less bulk will be always exactly one half, two thirds, three quarters, etc., of the original bulk, that is, it will bear a simple ratio to the same, as stated above. Ampère assumed that equal volumes of elementary gases contained the same number of atoms, that thus the numbers representing the specific gravity of the gases, when accepting the lightest, or hydrogen, as unit, also represented the atomic weights. Let us test this:

TABLE OF THE SPECIFIC GRAVITY OF SOME ELEMENTARY GASES AND VAPORS.

Hydrogen........................	H	=	1
Oxygen..........................	O	=	16
Nitrogen........................	N	=	14
Chlorine........................	Cl	=	36
Bromine vapor..................	Br	=	80
Iodine vapor....................	I	=	127
Phosphorus vapor..............	P	=	31
Sulphur vapor..................	S	=	32
Zinc vapor......................	Zn	=	65
Potassium vapor................	K	=	39

It is seen that the numbers for N, Cl, Br, I, P, and K correspond with the accepted atomic weights, while those of O, Zn, and S, are twice as large. If, therefore, the latter are adopted as representing the corrected atomic weights, we have also to correct some of the chemical formulæ in which they appear, as these formulæ are founded on the actual ratio of the constituents of bodies and the assumed value of the atomic weights. So water, which contains 8 parts by weight of oxygen with 1 of hydrogen, was expressed, after the old assumption of O = 8, by the formula HO; while, after the new assumption of O = 16, it must be written H_2O, in order to preserve the ratio, of its constituents, of 1 : 8. Ammonia, NH_3, hydrochloric acid, HCl, oxide of zinc, ZnO, and all those compounds of which the value of both constituents has not been changed, and also those of which the value of both has been doubled, remain the same. Thus sulphuric oxide, which consists of 2 parts of sulphur and 3 of oxygen, was written SO_3, which for the assumption of S = 16 and O = 8 is correct; but, for the new assumption of O = 16 and S = 32, it is equally correct. Sulphuric acid, however, which consists of the oxide SO_3 and an atom of water, which formerly was written SO_3HO, is now written SO_3H_2O, or $H_2(SO_4)$. Nitric oxide, which was written NO_5, becomes, by giving O the double value, N_2O_5; and, on combining it with an atom of water, it forms nitric acid, formerly NO_5HO, now $N_2O_5 + H_2O$, or $2(HNO_3)$. Phosphoric acid, formerly $PO_5 + 3HO$, is now, for the same reason, $2(H_3PO_4)$. Zinc oxide, ZnO, is the same, but potash, formerly KO, is now K_2O. Sulphate of potash, or potassic sulphate, according to the new system of naming, is $K_2(SO_4)$ in place of $KOSO_3$.

Since Claudius has shown that the law, which Gay Lussac found in a purely empirical manner, was a direct result of the theoretical assumption of Ampère, the new numbers have been adopted by the advanced chemists of the day; but it is to be deplored that a temporary confusion results, which is especially trying for beginners, chiefly because the existing books are almost all founded on the old formulæ, so that students trained only in the new style cannot understand them; and, in order to understand all, one must, now-a-days, be familiar with both styles of formulæ.

We will still add here the remark that the atomic weights for the alkaloid metals, lithium, sodium, potassium, rubidium and cæsium, are the same as before; those of the metals of the alkaline earths, magnesium. calcium, strontium and barium, have been doubled, as well as the earthy metals, and all the heavy metals, as well as carbon and silicon; but boron and arsenic are the same as before.

We close this article with a few of the modern methods of representing the manner in which the atoms in the compounds mentioned may be considered to be connected together.

$$\text{Sulphuric oxide } SO_3, \text{ or } \begin{array}{ccc} O & & \\ | & & \\ S & - & O \\ | & & \\ O & & \end{array}$$

$$\text{Sulphuric acid } H_2(SO_4), \text{ or } \begin{array}{ccccccccc} & & & & O & & & & \\ & & & & | & & & & \\ H & - & O & - & S & - & O & - & H \\ & & & & | & & & & \\ & & & & O & & & & \end{array}$$

$$\text{Nitric acid } H(NO_3), \text{ or } \begin{array}{ccccc} O & & & & \\ | & & & & \\ N & - & O & - & H \\ | & & & & \\ O & & & & \end{array}$$

$$\begin{array}{l}\text{Nitrate of zinc (old) } ZnO\,(NO_5), \\ \text{or zinc nitrate (new) } N_2O_6Zn, \text{ or}\end{array} \begin{array}{ccccccccc} O & & & & & & & & O \\ | & & & & & & & & | \\ N & - & O & - & Zn & - & O & - & N \\ | & & & & & & & & | \\ O & & & & & & & & O \end{array}$$

$$\text{Potassic sulphate } K_2(SO_4), \text{ or } \begin{array}{ccccccccc} & & & & O & & & & \\ & & & & | & & & & \\ K & - & O & - & S & - & O & - & K \\ & & & & | & & & & \\ & & & & O & & & & \end{array}$$

It is not asserted that these combinations represent the actual position of the atoms in the compounds, as they are here spread out over a flat surface, while in reality they are combined in all directions in space; but this way of presenting the combinations to the eye is a powerful aid to the imagination, chiefly in connection with the atomicity explained on page 232, above mentioned.

The experiments of Dr. H. Vohl, of Cologne, appear to prove that the carbonic acid obtained by heating charcoal is not derived from the coal itself, but has been absorbed from the atmosphere. This view is confirmed by the fact that when charcoal is freed from its carbonic acid and saturated with pure oxygen, no further trace of carbonic acid is discoverable, even when heated to 680° Fahrenheit.

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.

Notes & Queries.

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

1.—Separation of Mercury in a Thermometer.—How can I cause the mercury which has been broken or separated in a thermometer or barometer tube to unite?—F. D. H.

2.—Question in Acoustics.—Is there any instrument for measuring the force of sound, and how is it constructed? To what degree is it sensible, and does it record the force of each vibration, or only that of the maximum?—W. M. K.

3.—Coating Iron with Emery.—How can I cover a sheet iron cylinder inside with emery, so that it will form a covering as hard and tenacious as if on wood?—J. M.

4.—Tempering Plow Shares.—How can slabs of steel, such as plow shares, be hardened without their springing or changing their shape?—P. A. H.

5.—Galvanizing.—What is used, on the top of the pot of zinc, in galvanizing? I have heard of several things, and would like to know what is best.—J. T. B.

6.—Paint for Galvanized Iron.—I want a durable paint for galvanized iron roofing, and also for water tanks, bath tubs, etc., made of the same material.—W.

7.—Overshot Water Wheel.—What is the most economical motion for a 20 foot overshot water wheel, to gain the largest per cent of power for the water used?—M. H.

8.—Bats.—How can I banish bats from an old house? It is impossible to fasten the house up so as to exclude them, as they eat through and re-enter.—J. E. P.

9.—Cleaning Cotton Waste.—Would some of your correspondents kindly give me a simple and economical method of cleaning cotton waste, saturated principally with earth oil, to render it a second time usable?—S. R. F.

10.—Removing Salt Water Rust.—Is there any simple method of removing salt water rust from sheet iron, where the rust is on in spots? Are there any acids or liquids, into which the sheets could be immersed, which will dissolve and effectually remove the rust without eating or injuring the clean parts of the iron exposed?—S. R. F.

11.—Cement for Glass Gage Tubes.—What cement other than rubber can I use to cement a glass gage tube to its mountings, which will resist the action of the hot water and steam?—F. D. H.

12.—Working Corundum.—Will some one of your many readers inform me how corundum wheels are made, and if corundum can be molded and worked on an iron base? If it can, where can the pulverized corundum be procured?—A. D. C.

13.—Dyeing Skins.—I wish to know the process and ingredients used in producing different colors on the grain of sheep, dog, deer, and other skins used for gloves. I find no trouble in coloring after the grain is off, but cannot color with it on.—A. B. S.

14.—Painting Canvas Cover.—What can I paint a wagon cover with, to render it waterproof? The material is heavy ducking; the color is to be dark. I want something that will stand hot and cold weather, and neither crack nor peel off.—F. A. K.

15.—Expanding the Ends of Boiler Tubes.—What is the best mode of expanding the tubes of a steam fire engine boiler, so as to prevent leakage? There are 152 solid drawn composition tubes, which were put in with a dudgeon expander; and frequently the leakage of steam and water around the upper end of tube would be so great as to extinguish the fire. After several times expanding, I had the upper end of tubes feruled with taper iron ferules, which give entire satisfaction at that end, but now the lower ends weep, around each tube, so as to keep the wood in furnace perfectly wet, after six hours standing in house, with water cold.—A.

16.—Telescope.—Will some one please inform me how to make a telescope? I have an achromatic lens of about 34 inches focus, and two inches diameter. I have made a tube, of sufficient length, of brass. The eye piece is one taken from a smaller instrument. It contains four lenses. The first one, nearest the eye, is seven sixteenths diameter, the second five eighths, (these two are one and three eighths apart) the third lens is three eighths diameter, and the fourth, one half inch. These two latter are one and one half inches apart, so that the eye piece is four and five eighths long. Now when I put it together, and get it to the focus, the image is quite dim, so much so that the instrument is useless. Also: How can I grind a speculum, about four inches or five inches diameter, forty-eight inches focus, for a reflecting telescope? What kind, and what proportion, of metal would be best?—T. J.

17.—Telegraph Sounder Queries.—I have a telegraph sounder and key, of my own construction, worked by a Daniell battery. The magnet on my sounder was wrapped with cotton insulated wire, of the size known to operators as "office wire." This instrument works well, giving a clear distinct sound, as long as it is not in connection with an instrument such as is used in offices; but on connecting it with such an instrument it failed to operate, although the other instrument responded promptly to the manipulation of the key attached to my sounder, and the office sounder worked readily from its own key, without altering the connections. By cutting off from the office sounder, and attaching my sounder directly to the battery, it worked well; but it seemed that, after the current passed through the coil on the other instrument, it had no effect on mine. Is this due to the size of the wire, making a difference in the number of coils on the two magnets? If my magnet is wound with regular "magnet wire," will it operate in connection with the other instrument?—C. P. P.

Answers to Correspondents.

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

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

Power of Windmill.—Query 10, page 217.—For three horse power, in a gentle breeze, say at 22 feet per second, 334 superficial feet of sail will be required.—S.

Tanning Buffalo Robes.—O. A. R. will find an answer, to his query, on page 266, current volume of the Scientific American.

Polishing Gun Barrels.—E. O. McC. will find full directions for this process on pages 217 and 266 of the current volume of the Scientific American.

Welding Copper.—F. E. R., of Cal., is informed that we had the directions for this from a first class European authority on the subject. We shall be glad to have the experience of other readers, if there are any who have tried the process.

Rattlesnakes.—A correspondent, C. F. Gerald, of Camden, Ala., disputes the currently accepted theories about rattlesnakes, and asserts that they will bite when in any position, and in the daylight as well as at night; and he states that he can shoot them in the head with a rifle, hitting every time.

Violin Varnish.—Query 7, page 233.—Take two ounces gum shellac, half an ounce gum copal, one ounce sweet spirits of niter, one pint alcohol. Dissolve the gums in the alcohol, then add the niter.—F. D. H., of N. Y.

Cleaning Glass.—Let W. G. E., query 16, March 16, rub his glass with rotten stone and alcohol. This method is used by photographers for cleaning glass.—C. H., of Ky.

Fusible Metals.—To O. E., March 23, page 200.—An alloy of 8 parts of bismuth, 5 of lead, and 3 of tin melts at 212° Fah. Bismuth 2 parts, lead 1, tin 1, melts at 201°. Bismuth 5 parts, lead 3, tin 2, melts at 199°. By the addition of a little mercury, it becomes more fusible.—W. H. B., of Conn.

Brass Castings.—Query 27, March 30.—Make your sand as dry as it can be worked; do not pack it hard. Run your metal at a medium heat, give what vent you can, pour your metal in one hole, and allow it to rise out of another.—O. K., of ——.

Shaving with Pumice Stone.—If G. P. and H. E. M. will first shave their faces clean, but not so close as to leave a sore face, then get a piece of very small pored pumice stone, and use it frequently never allowing the beard to grow out, they will soon find it delightful shaving, keeping the beard always under the skin. This method of shaving has been in use in London for more than forty years.—A. D. C.

Fusible Alloy.—Rose's fusible metal contains lead 1 ounce, tin 1 ounce, bismuth 2 ounces, and melts at 200° Fah. Lippowitz's fusible metal is more expensive, and melts at 149° Fah. It is composed of cadmium, 3 ounces, tin 4 ounces, lead 8 ounces, bismuth 15 ounces.—J. S. of N. Y.

Driving Elevator.—To C. W. W., query 9, page 233.—I have repeatedly driven elevators from the bottom with perfect success, having elevated 3,000 bushels per hour. I place the upper pulley in a yoke raised by weights to give the necessary tension.—G. W. P., of N. Y.

Fruit Jellies.—To M., query 27, March 9.—Fruit jellies are made of sweet unfermented cider boiled in sugar to the consistency of jelly, flavored and colored to taste. The boiling point can be ascertained by frequently taking out a few drops of the article and cooling in a saucer or tin plate. Grind or crush your apples and press out the juice, add 3½ pounds of sugar to each gallon of cider, boil and strain through jelly bags. Flavor with the fruit the jelly of which you wish to imitate.—J. D. T., of Cal.

Test for Nitric Acid.—To P. C. H., query 19, March 9.—The best test for nitric acid is as follows: Put a few copper filings into the suspected article, and boil it; if it contains any nitric acid, it will give off red fumes.—J. D. T., of Cal.

Test for Lead in Water.—To F. C., query 24, March 9.—On adding a solution of sulphuretted hydrogen gas to water containing lead in solution, the water turns brown or black according to the quantity of lead in the water.—J. D. T., of Cal.

To Prevent Cider from Freezing.—To J. D. R., query 15, March 9.—There is nothing which you can put into cider to prevent it from freezing but alcohol; and a sufficient quantity of this would render your cider too intoxicating and unpalatable to be drinkable. The best way to prevent its freezing is to keep it in a cellar or bury it.—J. D. T., of Cal.

Preserving Natural Flowers.—Take some fine sand, wash it well and sift; mix thoroughly with a little stearin. Dry the flowers thoroughly from rain and dew; put them in a vessel and sift the sand all over them, so lightly that the leaves will not be injured, till they are completely imbedded. Expose the vessel and its contents to a gentle heat until they are dried; they will then retain their shape and color. This method is not so successful with flowers of which the petals are thick and contain much fatty matter as it is with the more delicate species.—G. H., of Mo.

Vacuum in Casks.—To J. A. P., query 6, page 233.—The weight of the atmosphere is more than sufficient to keep the liquid in a cask, but the cohesion of the particles of fluid, when presenting considerable area, is not sufficient to overcome their own weight as against the effort of the air to enter. Fill a goblet with water, and place carefully over it a piece of the finest tissue paper, and then invert and you will find that the pressure of the atmosphere will keep the water in. The cohesion of the particles of the paper seems to be enough to aid the particles of the water to maintain theirs.—E. H. H., of Mass.

Varnish for Violins.—J. D., query 7, page 233, may use shellac dissolved in alcohol, and add a little gum elemi to toughen it.—E. H. H., of Mass.

Gold Solution.—F. M., query 10, page 233.—To a dram of solution of terchloride of gold add two ounces of ether and shake together. Polished steel articles immersed in this clear liquor will become covered with a fine film of gold.—E. H. H., of Mass.

Preparation of Indigo.—To D. C., query 11, page 233.—Sulphate of indigo or chemic is prepared in the following way: The indigo is reduced to an impalpable powder and completely dried by a heat of 140° or 150° Fah. For each pound of indigo, six pounds of highly concentrated sulphuric acid are put into a large jar or earthen pot furnished with a cover. This is kept as dry as possible, and the indigo is added gradually in small quantities. The vessel is kept closely covered, and care taken that the heat of the solution does not exceed 212° Fah., but the heat must be kept at about 150° Fah., and allowed to stand, stirring it occasionally for forty-eight hours. If neutralized extract is wanted, the extract is put in hot water and well stirred, and a quantity of powdered chalk added until the acid is exactly neutralized; this is a nice operation and requires great care. Some dyers use carbonated alkalies to neutralize their acid. The sulphate of indigo of commerce is much better than that prepared by the dyer.—S. W. S., of N. Y.

Dyeing Prussian Blue.—To S. W. O., query 15, page 249.—Nitrate of iron is used as a mordant on cotton, and is prepared as follows: Ten pounds nitric acid of 36° Baumé, two pounds muriatic acid of 22° Baumé, and five pounds water in a stone pot; hoop iron or wrought iron chips are added slowly. When all the iron is dissolved, add slowly five pounds copperas. Old undissolved iron ought never to be left in. Fifty pounds of well boiled cotton are passed through a cold solution of four pounds nitrate of iron and six ounces of tin crystals. Give five turns, then take it to another bath of three pounds yellow prussiate of potash and one pound sulphuric acid; give it five turns in this, take it out again, pass back into the iron bath, and thence back into the prussiate bath, and so on until the required shade is reached. Rinse well before drying.—S. W. S., of N. Y.

Dyeing Green on Cotton.—Color twenty-five pounds of yarn with Prussian blue as above, but use more tin crystals. Rinse well, then boil ten pounds citron bark, strain it into a suitable tub, and add five pounds of alum. Enter at about 170° Fah., and handle for half an hour. Boiling will spoil it.—S. W. S., of N. Y.

Preparing Skeleton.—If G. L. F., query 10, page 200, will cut all the soft parts from his subject, remove the sternum at its junction with the ribs, and dislocate the large joints, put all in a watertight barrel (changing the water every week in summer) with the sternum so that he can watch it lest the cartilage be destroyed, or place his barrel in a running brook for two or three months in summer, he will have as nice and clean a skeleton as he can desire. If he uses any chemicals other than ether, he will certainly destroy his skeleton.—Ex., of Mo.

Worcestershire Sauce.—Take the walnuts when you can stick a pin through them and rinse them well; put a layer of them in a stone jar free from grease. Sprinkle each layer with salt until the jar is filled, cover, and let it stand five days. Strain off the juice after pounding the walnuts. To every gallon of juice add one pint of onions and one clove of garlic, each chopped fine, one ounce each of allspice, ginger, cloves, black pepper (all to be ground), a nutmeg grated, two ounces best cayenne pepper, and two quarts of the best cider vinegar. Put the mixture in a preserve kettle and set it on the fire; let it boil until reduced one third. When cool, bottle and cork tight. Age improves it.—S. E. M.

Breaking of Cast Iron Pulleys.—.—, page 185, is altogether in the dark, and so was C. M. R. in supposing the piece, broken from his pulley, was too long to allow of its being replaced. The rim of the pulley was thinner than the arms and center; hence, when cast, the rim cooled first and set, while the arms and center continued to cool and contract, which caused the arms, being curved, to spring outwards with a tendency to draw the rim inwards at the points of their connection; and when the arch of the circle was broken, the strain was relieved and all parts assumed their natural position; which movement shortened the diameter of the pulley equal to the former spring of the arms, and lengthened the whole rim in proportion to its divergence from the true before it was broken. Hence the opening from whence the piece was taken was made shorter.—C. H. J., of N. Y.

Fusible Metal.—To O. E., query 14, page 200.—An alloy of bismuth 2 parts, lead 1 part, tin 1 part, melts at 201° Fah. The addition of a little mercury will cause it to melt at a lower temperature; and with more lead and tin, it will resist a higher temperature. I have found that the same alloy under the same tension would part at different temperatures, a fact which is unaccountable to me. The metal is very unreliable, under tension, torsion, or compression. If your correspondent O. E., in his experiments, produces any satisfactory results, I should be pleased to know it, as it might be for his advantage as well as mine.—G. M. H. of N. Y.

Balancing Gang Saw Mills.—To E. F. J., query No. 18, page 154.—Attach two cylinders, with heads in the upper ends, sixteen inches in diameter, one to each side of the gang saw frame, so that the pressure of the atmosphere on the under side of the piston heads would sustain all the weight of the saw frame and its attachments. A vacuum will be formed above them by the descent of the heads, and a small valve should be made on the top of each cylinder head to permit the air that might get into it to escape.—J. C., of O.

Packing Rings.—Query 31, page 169.—D. & N. are informed that brass is one of the best packings in use. The rings should be all fastened together with a pin, made tight in the inside ring and between the outside ones. This is to prevent the rings from moving round so as to bring the open spaces together.—J. C., of O.

NEW BOOKS AND PUBLICATIONS.

The Rival Collection. J. W. Schermerhorn & Co., New York.

This is a handsome volume of 500 pages, containing pieces, serious and amusing, from our best writers. The selections are judiciously made by the editor, Martin Larkin, and consist of extracts from the choicest writings of the best authors. It is a book that should have extensive sale.

The American Historical Record. Edited by Benjamin J. Lossing. Published by Chase & Town, Philadelphia. $3 a year.

The April number is full of interest. Among other entertaining things, we find a variety of autograph letters from Lafayette, Cornwallis, Dartmouth, Rochambeau, General Pigot, and others. A chapter on the "Early History of American Wood Engraving" is given, with a *fac simile* of one of the earliest engravings—a portrait of Washington. It was a rough picture. We regard "The Historical Record" as one of the most useful periodicals of the day. Its pages abound with entertaining facts and curious details. Concerning the early condition of our country and the personages who figured in its history, it supplies very valuable information. Standard histories are necessarily confined to general statements; but the peculiar mission of "The Historical Record" is to give us the particulars, and this it does in the most interesting manner. It is ably edited.

Appendix to the Fifth Edition of Dana's Mineralogy. By George J. Brush, Professor of Mineralogy in the Sheffield Scientific School of Yale College. New York: John Wiley & Son, 15 Astor Place.

This is one of a series of appendices to be published from time to time to supplement the original work. The present one includes descriptions of eighty-seven minerals announced as new, and some important facts relative to others, the whole being arranged in alphabetical order for easy reference.

We are in receipt, from Mr. Francis A. Walker, Superintendent of the Census, of a copy of Statistics of the Population of the United States, as determined by the Ninth Census, and also of the Statistics of Wealth, Taxation, and Public Indebtedness.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 22 to March 28, 1872, inclusive.

Air Brake.—G. Westinghouse, Jr., of Pittsburgh, Pa.), London, England.
Artificial Stone.—F. Ransome, London, England, E. L. Ransome, San Francisco, Cal.
Combination Lock, etc.—T. J. Sullivan, Albany, N. Y.
Composition Bearing.—S. Croll, R. T. Barrett, E. T. Plush, Philadelphia, Pa.
Converting Motion.—R. M. Fryer, Nashville, Tenn.
Elevator.—A. M. Patrick, Long Lane, Mo.
Fire Extinguisher.—W. L. Ellsworth, Brooklyn, N. Y.
Freezer.—J. Tingley, Philadelphia, Pa.
Loom.—J. Shinn, Philadelphia, Pa.
Mechanical Movement.—A. B. Hendry, A. W. Webster, Ansonia, Conn.
Preventing Corrosion.—G. H. Smith (of New York city), London, Eng.
Retort Joint.—J. R. Floyd, C. F. Dieterich, A. Schlüssler, New York city.
Steam Street Car.—E. Lamm, New Orleans, La.

Recent American and Foreign Patents.

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

EXTENSION LATHE CARRIER.—William A. Lorenz, of Newark, N. J.—This improved extension carrier for securing work to the face plate of a lathe for turning, boring, or other purposes, consists in the construction and combination of two bars, one of which has two holes formed through it to receive the bodies of two screws, which screw into screw holes in the other bar to hold the work. The bars are arranged with their longer ends projecting in opposite directions. In the longer ends of the bars are formed screw holes at right angles with the holes above named, to receive the screws by which the carrier is secured to the face plate of the lathe. These screws pass through slots in the opposite sides of the face plate of the lathe, and which are in line with each other and with the lathe center. When the carrier is used as a common extension carrier, a tail is used, which is made with a long head to enter one of the slots in the face plate, and thus carry the work. When the carrier is used as an extension carrier on line lathe center, long screws are used, which are passed through the slots in the face plate, and are screwed into the holes therein, so as to hold the work back to the said face plate. With this construction these screw holes, as the carrier is expanded and contracted, will always be in line with the lathe center. The first and most important object of the carrier is its use as a tool for holding shafting and back to face plate of lathe by means of long screws passing through slots of face plate, the shaft meanwhile resting on a steady rest at one end, and on the live center of lathe at the other. The lathe center is the governing center point. The screws are screwed up until they just tighten the shaft on its center point. It is claimed to never spring out of center when held in this manner. In this position the screws act as tails to carry the shaft around. Drills or tools of suitable shape can then be brought to bear upon end of shaft. In ordinary machine shop practice, the common dog is tied with a string or belt lace back to the face plate, or a clamp with bolts (such as is used for holding wheels in boring lathes) is put before the dog, and fastened back to face plate against the dog by bolts. This extension carrier dispenses with these methods, and does its part quickly and in a workmanlike manner.

BRIDGE.—John H. Diedrichs, of Richmond, Va.—The object of this invention is to produce a practical suspension truss for bridges, which shall be economical in construction, durable, though light, and of graceful appearance, and in which a greater proportion of strength may be derived from a given quantity of material than in any other truss system now in use. The invention consists principally in a novel judicious distribution of the tie rods that connect the lower ends of the pendent posts with the top chord of the bridge. These tie rods are applied in the following manner: From the lower end of each post project two tie rods in opposite directions, but at equal angles, one to the nearest buttress, the other to the top chord. This will cause every post to be connected with but one buttress, except the middle post, which is united to both. At the upper ends only every alternate post is braced, provided the posts are all at equal distances apart from each other, which is preferable. The top chord and posts may as well be made of wood as of metal. In the first case, the upper ends of the tie rods are secured, where they join, to boxes placed upon the top chord. In the other case, the connecting bolts may pass directly through the metallic top chord. Contraction and expansion by cold and heat cannot injure or strain the parts of this bridge, as the tie rods projecting from each post are of equal length. A lateral shifting of the connecting pins is thereby made impossible from the above causes, which is an item of great importance, and an advantage of this system over most others now in use. The system recommends itself further on account of the equal thickness of the rods throughout for bridges of a considerable length, only the rods projecting from the posts nearest the middle may be made somewhat stronger. Other advantages are that by the proper distribution of tie rods the top chord is relieved from excessive strain, and will, therefore, be more durable; that special bracing of panels, etc., is unnecessary; and that the general appearance is harmonious and graceful.

PUMP.—Samuel M. Young and Philipp Brand, of Jacksonville, Ill.—A glass lining with tapered ends is inserted from the lower end of the barrel or stock, which is bored enough larger thereat than at the upper part, and a tubular plug of wood or other suitable substance is inserted below, which fits in snugly, and is flared at the upper end to wedge in tight between the stock and the barrel and the said tapered end. The upper ends of the barrel wedges are similarly fitted with the flaring shoulder of the bore. The plug may be tapered, if preferred. The bore of the lining and the wedge is the same size as that of the barrel above the lining. This lining is employed for its superior wearing qualities, and for the same reason a cylindrical glass valve seat is used in the top of the joint of a pipe which connects with the lower end of the barrel by being insulated in it. The pivot of the lever or handle is made square or of other angular shape in the part which fits in the lever, and round at the ends which are fitted in bearings to turn instead of having the lever turn on it, which makes a very much more durable arrangement, for the boxes and journals do not wear as fast as the lever when working on the pivot, and the lever is prevented from vibrating laterally as much as when turning on the pivot. The claim is for a glass lining for pumps, edge beveled and fastened by wedges.

STENCIL PLATE.—John McCullagh, of New York city.—This invention furnishes an improved stencil plate, so constructed that the letters or figures can be conveniently and quickly changed as may be desired. A top and bottom plate are hinged together. The bottom plate has cut therein as many square holes as it is desired to have letters or figures. Around this plate, at such a distance from the edges of the holes as will leave a margin wide enough to fully support the edges of the letter plates, is formed a rib. The letter plates each contain a single letter or figure, and they are laid side by side. Upon the inner side of the side, ribs are formed, or to them are attached, at the ends of the division bars between the letter holes, projections or stops to prevent the lateral movements of the letter plates. The corners of the letter plates are notched to fit upon the stops. The top plate, which is hinged at one of its side edges to the side edge of the bottom plate, is slotted longitudinally, the width of said slot corresponding with the width of the holes in the bottom plate, and its length being equal to the length of the series of holes in the said plate. To the under side of this plate is attached, or upon it is formed, a rib at such a distance from its edges that the rib will fit within the rib on the bottom and rest upon the edges of the letter plates, locking them securely in place. To the side ribs, at their lower inner edges, are attached, or upon them are formed, bars, the lower surface of which is flush with the lower surface of the ribs, and which are so placed as to overlap and fit closely upon the adjacent edges of the letter plates. The two parts of the stencil plate are locked, when shut down upon each other, by buttons or other suitable fastenings. The two parts of the stencil plate may be struck up out of sheet metal, or they may be cast, as may be desired or convenient. This is, we think, a very good and practical invention, as it will often save the use of many different stencil plates.

TUG CLIP.—John B. Welpton, of Tabor, Iowa.—This improved hame tug clip is so constructed as to allow it to be conveniently detached when desired for changing the hames or other purposes. The body or loop of the clip, which is bent or twisted to bring the loop that receives the hame staple at right angles with a bolt, passes through the eyes of the loop. The bolt is made with a head upon each end. The head upon the forward end is made oblong, and flaring upon two sides, and has a rabbet or shoulder formed upon the third side to receive the end of a small spring attached to the arm or loop. Both the holes or eyes of the body or loop are made oblong, so that the oblong head of the bolt may pass through them, and the forward hole is made flaring on its sides to correspond with the forward head, so that the bolt cannot come out when in use. In the other head of the bolt is formed a slot or groove to receive a screw driver for turning the bolt in inserting it and removing it. To remove the bolt, the point of some sharp pointed instrument is inserted beneath the free end of the spring, which is raised slightly, and, at the same time, the bolt is turned one quarter around, the head of the bolt passing beneath the end of the spring, and thus passing out freely. In inserting the bolt, the forward head of the bolt is passed through the holes or eyes of the loop or body until it rests against the spring, when a slight pressure and a one quarter turn with a screw driver brings it to its place. The spring does not require to be very strong as there is no strain upon it, its only office, when the clip is in use, being to keep the bolt from turning.

LOOM SHUTTLE ACTUATING MECHANISM.—George V. Sheffield and Walter S. Horton, Providence, R. I.—This invention consists of the application of steam or air or otherwise actuated pistons, with long projecting rods, to the lathe of a loom, for carrying the bobbin through the shed, a carrier for the bobbin being used that is adapted to be carried on the end of the piston rods when moved through the shed, and delivered to a holder or receiver ready for the rod on the other side, and the ends of the rods being magnetized to insure the holding of the carrier as they move backward with it through the shed. The two steam or air cylinders are mounted on the lathe, one at each end, in the place of the ordinary shuttle boxes, each of which has a piston with a long rod projecting in the crosswise direction of the loom, and capable of reaching through the shed, and withdrawing from the warp far enough to leave space for the bobbin carrier to clear the warp. Each cylinder is also provided with a steam or air chest, induction and exhaust ports, and a valve, by which to work the piston in the manner of ordinary steam or air engines; and it is also provided with springs for cushioning the piston at each end of the stroke. The valve will be shifted by any suitable moving part of the looms coming against arms or projections of any kind, on said valve, or connected with it in any way; or, the engines being moved with the lathe, the movement of the valve may be effected by the said projections coming against any fixed part of the loom. At each side of the warp threads, and under the positions where the carrier stops, is a block rising slightly above the top of the lathe, with the upper surface slightly descending toward the center of the loom, with two wings rising vertically from the upper surface and slightly converging toward the cylinders. The bobbin carrier is received upon these blocks between the wings at the return of each rod, and the rod withdraws lightly, leaving the carrier ready to be taken by the opposite rod after the beat and a new shed has been formed, when said opposite rod comes through, enters the tube, secures the carrier by the action of its magnetized end, and carries it back to the opposite side and leaves it, in like manner, ready for the next operation. Any kind of friction devices may be used to retain the carrier between the wings after the rod has been disconnected and while the lathe is beating up; or the magnetic attraction of the rod may be utilized for the purpose, the separation of the rod from the carrier not being so great but that the magnetic influence will be strong enough to retain the carrier; but the rod must not be so near that it will cause the opposite rod to fail of taking the carrier.

FASTENING KEY FOR COFFINS.—John Homrighous, Royalton, Ohio.—The object of this invention is to provide a substitute for screws, used in fastening the lids of coffins and for all similar purposes, whereby much time and annoyance may be saved. It consists in a key, ordinarily constructed so that it can be turned like a thumb screw. The shank of the key (see accompanying engraving) passes through the cover and enters the side or end of the coffin, the same as a common wood screw. One or more spurs project from the side of the shank near its end. These spurs are preferably flat and sharp on one edge, and placed spirally on the shank, or like the thread of a screw, so that when the key is turned the spurs will draw the key down and tighten the cover to the side, the same as would be done by turning down a screw, a shoulder on the shank of the key giving the desired hold on the cover. To apply the key, a hole is bored through the top or cover and in the side or end, and then a channel is cut in one side of the hole of sufficient size to admit the spurs. With the hole thus prepared, the key may be dropped into it, and when it is turned, the spur or spurs will penetrate the wood and act the same as a screw thread to draw the parts of the coffin, box, or other article, together. The lower edge of the obliquely placed spur is sharpened or made thin, so that it will readily penetrate the wood. Ordinarily, the spur or spurs will be placed so that the key would be turned to the right to fasten, and to the left to unfasten. One fourth of a revolution will do either. A great saving of time is thus effected, as compared with the time required for driving screws with a screw driver. The same device is claimed to be equally valuable on harrow teeth, gate hinge bolts, and other purposes. Those wishing to negotiate for the purchase of this patent may address the inventor as above.

CARBURETER.—Horace Holton, of St. Louis, Mo.—The cylindrical shell of this apparatus, which is divided into an air compressing chamber, gas chamber, and the gasoline chamber. The air is to be forced into the gasoline chamber and the mixers therein through a pipe by a water wheel consisting of cycloidal buckets and an air chamber at one end, into the top of which the air is forced, and into which the pipe extends above the level of the water to receive the air when so pressed in. The invention in this wheel consists in the cycloidal spiral buckets, which are claimed to be better adapted, by reason of their peculiar form and arrangement and the number used, say about eight, more or less, to produce a regular and continuous pressure and flow of air, which has heretofore been irregular in these machines by reason of the use of square shaped buckets of large capacity and few in number, which cause the air to flow in gusts. By peculiar mechanism the air is driven into a thin hollow cylindrical column, surrounding the float and enters the gasoline in a diffused condition very favorable to the necessary union. An agitating wheel is constructed in the form of an overshot wheel and driven in the direction to carry the fluid over and let it fall again in such manner as to agitate it very thoroughly. A combination of an agitating wheel with a gasoline chamber, as and for the purpose described, and a perforated cylinder and pistoned gas holder, arranged respectively in two adjacent chambers, constitute the claims allowed. The machine is driven by a weight and a train of clock work.

SAWING MACHINE.—Safaryne W. Nyce, Blooming Grove, Pa.—The several devices and arrangements, which are claimed to constitute a very efficient and desirable machine, are a combination of saw shafts, provided with driving pulleys, and having foot power apparatus, and a hand crank pin designed as a sawing machine for small shops, etc., where saws driven by steam, animal, or water power, are not available.

HUB FOR CARRIAGE WHEEL.—Isaac E. Bower, Bainbridge, Ga.—The box and principal portion of the hub is bored out to receive the nut and axle and the nut and washer and axle, as is usual in pipe boxes. There is a flange around this part, against which an inner spoke plate bears. The main spoke plate is bored, or an opening is made in it to allow it to slip on to the principal part, where it is securely held by a screw nut. The inner spoke plate is securely fastened to the main spoke plate by bolts, and confined between the principal part of the hub and the inner spoke plate thereby forming mortises for the spokes. The inner plate rests against the flange, through which the fastening bolts pass. A nut of sufficient size to cover the opening in the main spoke plate laps out on to it so as to hold it firmly to the main body of the hub.

PIPE TONGS.—James E. Roache, New York city.—This pipe tongs or wrench is of very simple construction, its moving jaw being arranged to slide, and actuated by a lever and spring, while the fixed jaw is adjustable by means of a screw. The main handle carries at its outer end a hook shaped block, in which the stationary jaw of the pipe wrench is held by a screw. The movable jaw of the wrench is fitted in a recess provided at the elbow junction of the handle and block. A lever, pivoted to a block directly behind the jaw, has a projecting lug that bears against the back of the jaw. A spring is concealed within a cavity of the block, and bears against the face of a stud which projects from the jaw. The spring has the tendency to crowd the jaw against the lever and to open the tongs, while the lever is used to bring the jaws together for clamping the pipe between them.

WASHING MACHINE.—John Eckerson, Spring Valley, N. Y.—This invention has for its object to furnish an improved washing machine, is designed to wash the clothes thoroughly and quickly, so that there will be no necessity for rubbing any part of them. It consists in a combination of a frame, legs, tub (corrugated vertically upon its inner sides), disk, shaft, detachable cross bar, cross bars, corrugated rollers, springs, guide pins, crank and cover with each other, the combination being peculiarly made to effect the purpose named.

FIREPROOF BUILDING.—Joseph J. Bartlett New York city.—This invention consists, principally, in the use, for building purposes, of paper or composition containing asbestos when applied to a metallic framework in sheets or sections of suitable extent. The invention also consists in the peculiar arrangement of the metallic framework, although the inventor does not confine himself to any peculiar form and arrangement of parts. The main invention is the construction of a fireproof building of metal and asbestos fabric. These substances are fireproof, durable, strong, and waterproof to all practical intents, and, therefore, it is claimed, best adapted, when in combination, to the purposes specified.

HOE.—John S. Carroll, Covington, Ga., assignor to himself and J. W. Rogers, same place.—This invention furnishes a hoe, for the cultivation of cotton and for other purposes, claimed to be better adapted to the purpose than hoes of ordinary construction. It consists in the construction of the blade, and in a detachable shank and parts connected therewith. The blade has four cutting edges, and is otherwise peculiarly formed. The handle is fastened to the blade by a ring and key in a very novel manner The invention is in every way unique, and is one which a thorough practical trial may prove valuable.

CLIPPING MACHINE.—James W. Moyer, Cooperstown, N. Y.—This is an improvement upon that class of horse clippers in which air power is employed, either upon the compressive or exhaustive principle. Pumps of any suitable kind, or any equivalent thereof, for impelling the air, with conducting tubes of flexible character, air chambers, and flexible diaphragms for actuating the movable cutter bar are used, said bar being connected to the said diaphragm in any suitable way to be moved by them as they are moved by the air, the said apparatus being either double or single acting, according to preference. The diaphragms, which are caused to vibrate by the alternate action of air forced against one side, and the action of the external air on the other side when the first side is relieved from pressure are arranged in the handle employed for moving the clippers around the body of the animal, while the pumps or other impelling apparatus may be affixed to the side of the stall or to a portable support for moving about from one stall to another.

BELT TIGHTENER.—Homer C. Allyn, Fall Village, Ct.—The invention consists in providing the single bearing which holds the fly wheel shaft of a sewing or other small machine with means for quick and easy adjustment, whereby the belt which drives the mechanism may be tightened when it is desired to start the machine and *vice versa*.

APPARATUS FOR TRANSPORTING VESSELS OVER BARS.—John E. Worthman, Mobile, Ala.—This invention relates to a floating apparatus designed for taking in vessels, without unloading, and transporting them over bars, shallows, etc., where there is not sufficient depth of water to allow the vessel to pass when loaded.

BORING MACHINE.—Jacob Gardner, Bigler, Pa.—The invention consists in a boring machine in which posts or rake heads, having different intervals between their mortised holes, may be readily and successively bored without any but a single and momentary change. In miscellaneous work, it must necessarily be a great saver of labor.

MACHINE FOR BORING HUBS AND TENONING SPOKES.—Jacob Gardner, Bigler, Pa.—This invention relates in part to a machine for boring into wheel hubs the radial holes necessary for the making of the mortises which receive the butts of the spokes, the invention comprising, under this head, a device for placing the hubs at such an inclination from the perpendicular while they are being bored as may serve to produce holes sufficiently inclined to the axes of the hubs to give the spokes, when placed in such holes, the requisite "dish" or slant. The invention also relates to a machine for tenoning the outer ends of spokes, and includes under this head a device for clamping the spokes while the tenons are being formed on them.

COTTON CHOPPER AND CULTIVATOR.—James M. Harcrow, Marshall, Texas.—This invention relates to a machine by which a row of cotton plants is barred off on both sides, chopped, and dirted all at the same operation, the machine being provided with a shield to cover the chopper and prevent it from injuring the limbs of the operator.

CORN PLANTER.—Morriss Schnapp and Wm. J. Hollis, Dewitt, Mo.—This invention consists in an improved construction of devices for planting and dropping corn which are specially adapted for attachment to the beam of an ordinary shovel plow or cultivator from which they can be readily detached when desired.

WASHING MACHINE.—Mrs. Sarah Mundy, (administratrix of James H. Mundy, deceased) and Robert P. McConaughy, of Washington, Iowa.—This improved washing machine is claimed to do its work quickly and thoroughly, whether few or many clothes be operated upon, and not to injure the most delicate fabric. It consists in the construction and combination of various parts by which stationary and movable rubbers act upon the clothes so that they will be completely turned over as they pass from the higher to the lower parts of the rubbers, and all their parts will be completely cleaned.

COMBINED LATCH AND LOCK FOR SLIDING DOORS.—Charles W. Chappell, of Watertown, Wisconsin.—This invention relates to an improved lock for folding or sliding doors; and consists in a new arrangement of swinging latch and mechanism for locking the same by a spring bolt, and unlocking it from the outside by means of an eccentric and from the inside by a lever. A swinging latch arranged in combination with a spring bolt, rib, lever and eccentric, arranged to operate in a peculiar manner, are claimed, the combination evidently making a good and neat lock for the purpose set forth

COMBINED SPLICE AND SAFETY HOOK FOR LADDERS.—John Edmunds, South Adams, Mass.—This is a device for splicing ladders, and for adaptin an ordinary ladder for use as a roof ladder. Two or more ordinary ladder about the construction of which there is nothing new, may be used. A b of iron, the upper end of which is bent forward to form a hook, is employ to catch upon the ridge of a building when the ladder is to be used as a roof ladder. The lower end of the bar is bent forward to form a hook to catch upon a round of the ladder. The middle part of the bar is slotted longitudinally, to receive the shank of a second hook so that the latter can be moved toward or from the first hook, according as the rounds of the ladder may be further apart or closer together. The second hook, when adjusted, is tightened upon the round of the ladder by a hand nut, screwed upon its shank upon the other side of the bar. Upon the other side of the lower part of the bar is formed, or to it is securely attached, a third hook, to receive a round of the upper ladder. Still a fourth hook takes hold of another round of the upper ladder. The shank of this hook passes through the slot in the bar, and is secured in place, when adjusted, by a hand nut, according as the rounds of the ladder may be further apart or closer together.

MONEY POCKET FOR GARMENTS.—Ernest Schnopp, of East New York, N. Y.—This is a new combination of pocket books with articles of wearing apparel, consisting in the direct application of such books to the garments as pockets, thereby providing the necessary divisions, etc., without requiring the carrying of a separate receptacle. The pocket book is applied as pocket to an article of wearing apparel for either ladies or gentlemen, it being applied under the outer fabric of the garment like any ordinary pocket, and closed by a flap, which is also covered with the fabric constituting the garment. The interior of the pocket book is of suitable construction, also the snap or lock whereby the same is closed.

PLOW.—Samuel A. Fanning, Jacksonville, Ill.—This invention furnishes an improved riding plow, claimed to be simple, convenient, and effective. The features of the invention embraced in the patent are a roller, arranged in a peculiar manner in the rear and to one side of the turn plow, so as to pulverize the furrow slice as soon as turned over, also a bar pivoted to the heel of plow, and notched so as to fasten over a bar on the rear of the plow frame, to give steadiness and firmness to the plow, and to aid it in resisting side draft.

SASH HOLDER.—William W. Amos, Olathe, Kansas.—This invention furnishes an improved device for holding and locking window sashes, simple and not liable to get out of order, and which will hold the sash securely at any desired point, lock it when up or when down, and which may be readily applied to any sash, and will not disfigure the window. A combination of a box, rubber rollers, ratchet wheels, spring pawl bar, and spring or springs, also a combination, with the spring box, of an extension or flange, carrying the spring and fastening bolt, constitute the claims embraced in the patent.

WASHING MACHINE.—Grove M. Hall and Lawrence White, of Orford, Iowa.—This invention has for its object to improve the construction of a washing machine for which letters patent were granted February 21, 1871. By this new arrangement of the parts of the machine, the space for the clothes is brought forward into a much more convenient position, and, at the same time, the machine is adapted to receive a wringer, so that the clothes may be wrung directly from the box. The power is also applied to the beater more directly and more advantageously. The clothes are pressed and slightly rubbed, and, as they are released by the rearward movement of the beater, fall back into the water, turn partly over, and change their places, so as to always present different parts to the faces of the beater and washboard.

FURNACE GRATE BAR.—William Mellor, of Paterson, N. J.—The main or upper portion of this grate bar is an open tube from end to end. A rib is attached to the under side of this tube. There are openings from the top of the bar into the tubular opening, also openings on the under side on each side of the rib into the tubular opening. Recesses in the sides of the bar form full openings through the grate when the bars are placed side by side to form the grate of the furnace. These grate bars are so placed or arranged on their bearers at each end that the air has a free circulation from one one end to the other, and they may be connected with an air chamber at their front ends, so that, when a blower is used, air may be forced into the chamber and grate bars and distributed through the side openings, not only to increase the combustion of the fuel, but to preserve the bar from the effects of intense heat. The ordinary or natural draught of the furnace operates in the same manner, but is modified in degree according to the power of the draught.

EXTENSION TABLE SLIDE.—Samuel R. Garner, of Independence, Iowa.—The object of this invention is to simplify and render more strong and durable the slides or adjustable rails of extension tables. In an extension rail composed of three or more sections, the two outside sections are provided with diagonal or angular grooves, and the middle section has the same description of grooves in both its sides. The grooves are made in pairs, and are uniform as regards their depth, angle, and distance from each other. Lips of clasps enter the grooves and slide therein, and thus form the connection between the sectio s. The outer sections of the rail are connected with the legs of the table by tenons. Loose strips in the grooves limit the movement of the sliding sections. The clasps at the ends of the sections serve to strengthen those parts and prevent the ends from splitting. The center or middle section is stationary, and while the parts are securely held held together by the clasps, the other sections are drawn out and the table extended, as may be desired.

PLOW.—James M. and Geo. W. Moyers, Gordonsville, Va.—This invention relates to certain improvements in the construction of the moldboard, land side, slide or wheel, point and share of a plow, all tending toward increased simplicity and strength in the machine.

[OFFICIAL.]

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DESIGNS PATENTED.

5,767.—CARPET.—T. Barclay, Lowell, Mass.
5,768.—CARPET.—M. Blatchford, Halifax, England.
5,769.—BREASTPIN.—A. V. Bock, Chicago, Ill.
5,770.—CARPET.—J. H. Bromley, Philadelphia, Pa.
5,771.—CARPET.—R. R. Campbell, Lowell, Mass.
5,772 to 5,774.—CARPETS.—J. M. Christie, Lowell, Mass.
5,775.—CARPET.—P. Chorier, Paris, France.
5,776.—STEAM ENGINE.—C. M. Farrar, Buffalo, N. Y.
5,777.—BADGE.—M. Feely, Providence, R. I.
5,778 to 5,781.—CARPETS.—J. Fisher, Enfield, Conn.
5,782.—CARPET.—O. Heinigke, New York city.
5,783.—SHAWL FABRIC.—J. Hodgson, Philadelphia, Pa.
5,784 to 5,786.—CARPETS.—H. Horan, Newark, N. J.
5,787.—CARPET.—L. Jullien, Passy, France.
5,788.—CARPET.—L. G. Malkin, New York city.
5,789 to 5,791.—CARPETS.—W. Mallinson, Halifax, England.
5,792 and 5,793.—CARPETS.—A. McCallum, Halifax, England.
5,794.—CARPET.—D. McNair, Lowell, Mass.
5,795 and 5,796.—CARPETS.—E. J. Ney, New York city.
5,797.—CARPET.—J. J. Patchett, Halifax, England.
5,798 to 5,802.—CARPETS.—E. Poole, Halifax, England.
5,803.—CARPET.—H. Robinson, Halifax, England.
5,804.—CARPET.—J. H. Smith, Enfield, Conn.
5,805.—INKSTAND.—L. L. Tower, Somerville, Mass.
5,806.—FLOWER POT.—G. P. Palmer, Boston, Mass.

TRADE MARKS REGISTERED.

765.—Suspended.
766.—BOOT TOPS.—C. H. Colburn, Milford, Mass.
767.—CHEWING TOBACCO.—A. Gillender & Co., New York city.
768.—STARCH.—T. Kingsford & Son, Oswego, N. Y.
769.—WHITE LEAD.—R. Lewenthal & Co., New York city.
770.—SOAP.—J. Oakley, New York city.
771.—AXLE OIL.—C. C. Richmond, Boston, Mass.
772.—LUBRICATING OIL.—The Galena Oil Works, Franklin, Pa.
773.—MOWING, REAPING, AND HARVESTING TOOLS.—The Greenwoods Scythe Company, New Hartford, Conn.
774.—CORN KNIFE.—The Greenwoods Scythe Co., New Hartford, Conn.
775.—PERFUMERY, DRUGS, AND MEDICINES.—W. A. Weed & Co., Chicago Ill.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

20,775.—SEWING MACHINE.—R. Blake. June 19, 1872.
20,928.—MACHINE FOR CLEANING GRAIN.—W. H. Orr. June 26, 1872.
21,004.—MACHINE FOR PILING PAPER.—J. C. Kneeland. July 10, 1872

EXTENSIONS GRANTED.

19,855.—ICE PITCHER.—E. Kaufmann.
19,824.—SIRUP APPARATUS FOR SODA WATER.—E. Bigelow.

Practical Hints to Inventors.

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How Can I Obtain a Patent?

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

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Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

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