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Radial Drilling Machine.

Every machinist employing the ordinary machines for drilling purposes must suffer from the inconveniences resulting from setting, resetting, and leveling his work, especially when it is of an un wieldy or cumbrous character, and a series of holes parallel with each other is required. Although it is essentially a simple operation to drill a hole, yet under these circumstances it is on e into which expense and annoyance enter very largely.

It is very difficult to meet a condition which brings the exact location of the proposed hole directly beneath the drill, and also has the position of the work correct in point of level; this is, in a greater degree, an embarrassing task when an irregular form of considerable weight is elevated on blocks, and has to be moved about on them; bars, rollers, blocks, and wedges are continually in requisition, and one or more laborers stand idly by surveying the performance preparatory to the next move.

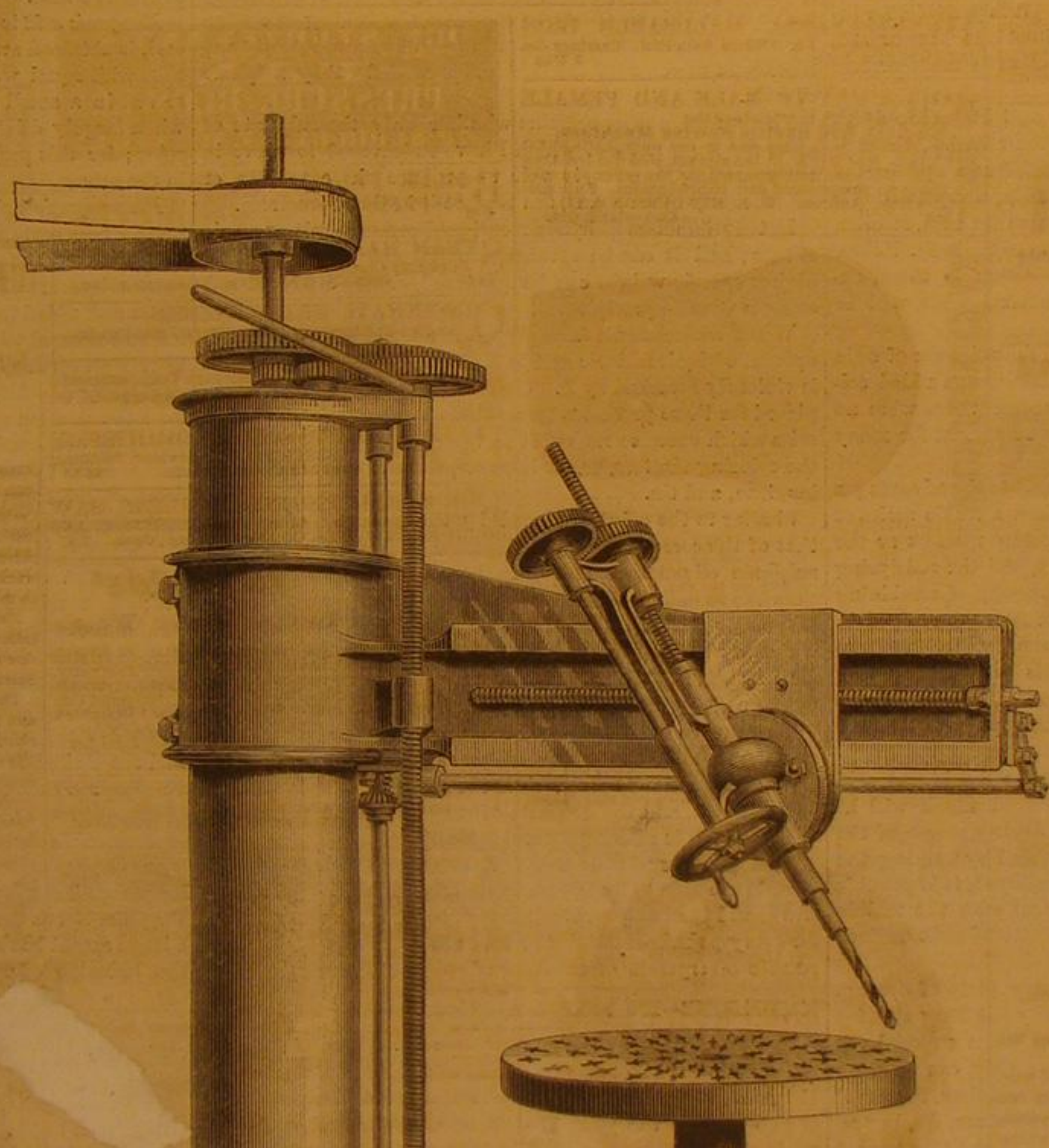
The tool represented in the annexed engraving overcomes the necessity of moving the work, as it is capable of drilling a hole at any angle and at any hight within its scope. It may be described as follows:

The whole machine swings around a stationary sleeve, bearing well up in the interior of the column; the nuts shown at the bottom are intended to secure it, but this provision is not needed in practice, as the fit is thorough and the bearing ample; the upright column is turned all over, and the arm is snugly fitted to it; the upright screw is employed for raising and lowering the arm by power, and is brought into action by the lever seen at the top of the column. As it is desirable that no belts should intervene to mar the complete revolving sweep of the machine, the driving is applied through the center direct, and transmitted to the upright shaft, whence the horizontal shaft carries it to the spindle by means of two pairs of miter gears. This arrangement also provides for the complete swiveling capacity of the drill spindle, so that it can be used horizontally, vertically, or at any angle with equal facility. The movement of the head, inward and outward on the arm, is accomplished by the horizonal screw. The table is for the convenience of the smaller class of work.

The countershaft supplies the requisite number of changes in speed.

We think it impossible to combine more excellent features with greater simplicity than is evidenced in this machine; an ordinary drill press is just as liable to get out of order, and one of the same dimensions would cost more money.

The Universal Radial Drilling Machine is designed and manufactured by the Niles Tool Works, of Cincinnati, Ohio, to whom all orders should be addressed.



IMPROVED UNIVERSAL RADIAL DRILLING MACHINE.

Human Degeneracy.

A marked degeneration has been observed to have taken place of late years in the *physique* of the inhabitants of Paris. The true Parisian is stunted in growth and of muddy complexion: his children are under-sized, emaciated, and pale. He chiefly dies of *ennui*—at least if we are to believe one of the Paris *savants*, Dr. Raoul le Roy, who has made this subject a special study for many years. According to M. le Roy, for instance, in spite of the solicitude manifested by government towards the hygienic welfare of all classes, in spite of the new plantations, the new boulevards and open squares, the amount of carbonic acid produced by the pulmonary emanations of two millions of human beings, each of whom daily exhales 219 grammes of oxide of carbon, is something frightful. To this noxious vapor must be added that produced by the gas manufactories, etc. Another cause for the impoverished blood is the enormous increase of the use of tobacco and alcohol. The consumption of the latter has exactly doubled since the year 1825. As to tobacco, in 1832 it produced a tax of 28,000,000f.; while in 1862 the consumption of tobacco brought into the government a sum of 180,000,000f. In 1852, 200,000,000 cigars were smoked in Paris, whereas, in 1867, the number increased to 761,625,000.

Man, or the Living Machine.

The Right Rev. Thomas M. Clark, Bishop of Rhode Island, recently delivered a very interesting lecture on man, at Trenors Hall in the Sixth Avenue—He began with alluding to the complicated machinery of an orrery, used in illustrating the motions of the heavenly bodies. The machinery of man was the same, but more complicated and more mysterious. There were in the room one hundred perfect machines, with all the bolts, screws, levers, and other appurtenances of machinery. There were also one hundred steam engines with valves, wheels revolving, and steam generating. There were also one hundred galvanic batteries with electrical currents in full operation. These machines were not over six feet long and often less, and, as it frequently happened, there was the largest power in the smaller machines; as for instance, in the first great Napoleon. A peculiarity about these machines was their regulating themselves as well as their power of reproduction. He referred to the use of the hand. Six thousand years ago it was used in collecting materials for clothing the human body, and in gathering sticks and rubbing them together to m[illegible]e to warm the body. This hand had had worked [illegible]nce. Speaking of man as one machine, it had subd[illegible]nd replenished the earth. This man had cut d[illegible]l built cities; constructed ships, the steam en[illegible]graph. He compared man to the animal cr[illegible]e most perfect cells, beavers built bridges [illegible] showed a diversity of mechanical skill. [illegible]mals had improved. They were the [illegible]s of years ago; no one race of anim[illegible]cessors. It was not so with man; he was constantly improving and would continue to improve. Next he spoke of the transmission of certain characteristics both in the brute and the human creation. The young of a shepherd's dog would, for instance, take to guarding sheep instead of worrying them, the natural instinct of dogs. With man influences of a generic character often showed themselves through generations. The mystery of man had never been solved—never would be. No perfect automaton had ever been made, and yet a man would stand in health without effort, and almost unconsciously. He alluded to the delicate formations of the eye and the ear. What, give sight to the eye? What, give hearing to the ear? Here was mystery, and the only solution was that the soul was the center of the senses. The body, he urged, was but a mass of sinews and gases, a mixture of solids and liquids. The soul was really the living man. A marvel transcending all others was the transmission of thought through the medium of speech. A thought possessed him; he gave motion to the complex machinery of his throat, opened his mouth, moved his tongue and lips, gave a vibratory motion to the air, and the thought, as a spoken utterance, reached the tympanum of another's ear, and the latter, by the same process, sent back his or her thought to him. From this topic he proceeded to speak of the effects of climate on man. No great man, he insisted, was ever born on the equator, and neither was the country of the Esquimaux favorable to the production of genius. The men of real power—the great leaders and shapers of the world's destiny, were born in the temperate zone. He urged in this connection that to the proper education of the soul through the body good air and good food were essential—a point that he forcibly illustrated at some length. Digressing from this point he gave his views upon the effect of spirituous liquors upon the body.

Liquor slammed all the doors of the soul and kicked up as much commotion as if so many evil spirits should commence playing upon all the organs in this city. After alluding next to the specific form of various anesthetic agents upon the human system, he spoke of the power of panics and cited several ludicrous instances bearing upon this point. He also referred to election excitements, speaking particularly of the Tippecanoe excitement in 1840, which, he said, caused the solid men of Boston to kick up antics in the street which they would whip their children for doing. His next topic was dreams, which he showed to be among the most inexplicable mysteries in connection with man. A most interesting digression was here indulged in on the subject of spiders. He instanced the sagacious capture of a snake by one, and also gave an experience of his own with one, that some years ago wove a web in his study. This spider he took under his charge and fed him, and the latter, as human beings are apt to do when helped, relied on him for his daily food. One day he threw a piece of sugar in the web. The spider made for it, thinking, doubtless it was food, but, discovering its nature, was intensely disgusted, and at once essayed its removal. He tugged on it awhile to loosen it from the web, but was unable to do this. Withdrawing for meditation, he soon returned, cut off one after another of the enveloping threads, and down fell the piece of sugar, and then repaired damages. Here he insisted, was thought, and he gave other equally curious and interesting illustrations, evincing in dumb creation the same capacity of thought. Reverting to man in conclusion he spoke of life here as a preparation for immortality, and the duties incumbent on man.

If it be true, as stated, that the metallic base of hydrogen is discovered, the field of chemical discovery is widened beyond the reach of conjecture.

SALT-CAKE IN DYEING.

Written for the Scientific American by DR. H. REIMANN.

In England, as well as in Germany, salt-cake, or sulphate of soda, has been employed for some considerable time already as an expedient in dyeing wool.

The practical dyer, when asked concerning the advantages of this substance, which seems to possess so little importance, for the dyeing process, can state no reasonable ground for its employment, only in rare cases you will perhaps hear that the bath dyes more equally when sulphate of soda is added to it. Even the chemist, on regarding the matter somewhat superficially, does not observe what purpose the sulphate of soda serves in the dyer's bath. He considers it one of the number of utterly useless substances employed by the dyers in accordance with the prescriptions of some hand-book.

Nevertheless, if we regard the matter carefully in the following discussion, we shall see that sulphate of soda can be of the very greatest value in dyeing processes, and that its employment is based on the most interesting chemical and physical principles. At the same time we shall be obliged to advance into the comparatively unknown region of the dyeing theory, the practical use of which we shall soon recognize.

The sulphate of soda, which is scarcely ever treated of in books on dyeing, because of its chemical indifference for coloring matters, elevates, as every soluble substance does, the specific weight, and thus also the boiling point of the solution. This property already, when taken into consideration, renders it important for many dyeing processes. It is possible, for instance, to change the shade of aniline violet into blue or red, according as the temperature of the solution is more or less elevated.

When the dyeing is performed in an acid bath (the dyers very frequently add sulphuric acid to their baths), the sulphate of soda combines with the free sulphuric acid in the bath, and forms with it bisulphate of soda, a crystallizable solid salt. In this manner the bath retains its acid reaction without the presence of free sulphuric acid in the bath. Hence, when half-woolen cloths are dyed, the cotton in them, extremely sensitive to the action of the mineral acids, will be very well preserved.

Dissolved in water in great quantities, the sulphate of soda diminishes the capacity of the bath to dissolve the added coloring matters in as great a degree as though there were no such salt present; this, too, is highly important for many dyeing processes.

Several practical examples will demonstrate the advantages of sulphate of soda more conclusively than a whole series of theoretical observations. The red coloring matters as the cudbear, and more especially the magenta, and the red dyeing woods, possess, as is well known, the property of combining only with the greatest difficulty with the fiber when dyed in an acid bath. Therefore, wherever the substances are employed in the acid bath—and often this is necessary—the greatest part of the coloring matter is wasted and lost if the common process is employed. The same applies also to the yellow wood.

If, however, the said coloring matters be dyed in an acid bath according to this new method, a twofold result will be attained. By adding sulphuric acid, the dyeing power of the said pigments can be put into activity, and by varying the quantity of sulphate of soda which is employed, it is possible to control the combination of the pigment with the texible fiber. Therefore, by means of the sulphate of soda various shades can be produced.

This fact is of great importance in many sorts of dyeing. There are some kinds of yarn, especially the long *slubbing* wool, which have the property of felting when exposed too frequently to a change of temperature; they can then no longer be worked into weft yarn. Nevertheless, the wool must be exposed to such a change of temperature, for, in preparing the shades, it is taken out of the bath at times, so that new coloring matter may be added to the part already in the bath.

In all these cases it would be unnecessary to take out the yarn if we were to add a little more coloring matter and acid, and shades could be produced by gradually adding sulphate of soda to the bath. By this process a great deal of manual labor may be spared, and the dyer enabled to work with far more security and comfort. Should at any time too much coloring matter have gone upon the fiber, the fault can readily be corrected by the addition of a little acid.

The truth of the above assertions is most easily perceptible in dyeing Magenta. As another example, let us regard the dying of shades, for which the wool must first be boiled in a solution of a chrome salt, in the most cases in bichromate of potash. This is often done for red, brown, and gray, which are produced by means of logwood, red and yellow wood. When the wood is boiled in a bath of bichromate of potash, and especially when to this, as is commonly the practice, sulphuric acid is added, the colors of the logwood and red wood attack the fiber very quickly, and therefore often spread unequally. Hence, dyers must begin to dye at low temperatures, and must increase the heat very slowly. If to such a dyeing bath but a small quantity of acid is added, the effect of the coloring matters in it is almost nothing, it is, therefore, possible to dye with the boiling bath without fear of an unequal spreading of the coloring matters. It is only necessary to add, while the coloring matter is fixing on the fiber, sulphate of soda in small quantities, the coloring matter will combine with the fiber, while the sulphate of soda absorbs the free acid. It is therefore possible to produce shades without removing the goods from the bath, if we take care that the quantity of coloring matter which is at first added to the bath is not too small.

A similar effect can be produced by adding the sulphate of soda at the beginning of the dyeing process. For sulphate of soda we may, in this case, employ even common salt. In this case the salts employed will, when dissolved in the fluid, precipitate the dissolved coloring matter, which is then contained in the bath, in a very fine state of division, or the salts will prevent the coloring matters from dissolving, according as these latter or the salts were first introduced into the bath.

For the process this is quite indifferent. The pigments fix on the fiber in the same measure as they are dissolved. Fresh coloring matter will only then be dissolved, when the portion already in dissolution is already consumed. The dyeing is more equal, if the coloring matters are not dissolved in the bath, but are contained in it in a state of minute division, as every dyer knows who has ever employed aniline blue, soluble in water. This pigment, because of its ready solubility in acids, often fixes too quickly if the dyeing is carried on in an acid bath, and therefore dyes at times unequally. It is therefore best to dye from a neutral or weak alkaline fluid, and then to produce the blue by adding an acid. The same pigment soluble only in alcohol is precipitated as soon as its solution is added to the bath, and therefore dyes more equally, though more slowly still. In many cases also it is advantageous to employ sulphate of soda where small quantities of indigo carmine are used to give somewhat more of blue to a shade. The affinity of this coloring matter for wool being very great, small quantities of it may often dye the woolen goods very unequally; to prevent this, and give uniformity to the color, it is necessary to continue the boiling operation for some time. The indigo carmine will dye more slowly and equally in the case of the free acid is carried off by sulphate of soda.

The question now remains whether only the sulphate of soda, the importance of which I have endeavored to prove in the preceding remarks, is able to produce these results, or whether any other agent, can replace it in these processes.

In the preceding I already mentioned common salt as a substitute; and it can be advantageously employed, if either a higher specific weight can be produced, or the dissolved coloring matter be precipitated.

When common salt is employed in an acid bath, the development of hydrochloric acid is highly disagreeable. Cotton is violently attacked by it. Common salt can in turn be replaced for these processes by sulphate of magnesia and other salts which exercise no effect on the chemical constituents of the coloring matters, as, for instance, the compounds of alumina, iron, and tin.

Similar to the effect produced by the sulphate of soda, is that of the corresponding combination with potash, viz.: the sulphate of potash. This salt, however, is more expensive than the soda-salt. The bisulphate of potash is now already frequently employed in dyeing. The bisulphate of soda, which is a residium in some chemical manufacturing processes, for instance, in the production of nitric acid can often be advantageously employed for sulphate of soda and free acid.

To compare the expense of the employment of these substances, we must therefore observe that the sulphate of potash crystallizes without water, while the sulphate of soda contains 55·9 per cent, and the sulphate of magnesia 51·22 per cent of water, which is of course devoid of any value.

Finally, we must state that 100 parts of crystallized sulphate of soda are able to fix 30½ parts of sulphuric acid (of 66° B. s. w.), and thus to form bisulphate of soda; or, in other words, for every pound of sulphuric acid added to the bath, three pounds of crystals of sulphate of soda must be employed.

MANGANESE—ITS USEFUL APPLICATIONS IN THE ARTS.

BY DR. L. FEUCHTWANGER.

This mineral substance was known in ancient times under the name of "glassmaker's soap" and was considered a species of iron ore. In the year 1740 it was ascertained to be an oxide of a separate metal, and in 1774, Gahn obtained the pure metal from the native carbonate, exposing the same to intense heat for several hours, or by subjecting chloride of manganese to electrolysis. Boerhaave does not appear to have known the metal. In my English edition of 1753 he speaks of it in the following words: "Take the frit and set it in melting pots in a working furnace, adding in each pot a proper quantity of a blackish stone not unlike loadstone, and called manganese, which serves to purge off that greenish cast natural to all glass and to make it clear." Scheele, Bergman, Chevreul, Berthier, and Berzelius, have in modern times investigated the physical and chemical characters of manganese. The ore is widely distributed over our globe; it accompanies many iron ores, particularly the hematites, also the franklinite of New Jersey. It has been detected as a constituent of meteoric iron in the ashes of most vegetable and many animal substances, in the coloring principle of many fossils in a dendirtic form in the chalcedony which is called the "mocha stone," and in the same form on sand pebbles of which I found plenty in Stanislaus River in California. It also occurs combined with sulphur, carbonic acid, silica, water, and with many atomic proportions of oxygen, such as protoxide, sesquioxide, binoxide, manganic acid, and permanganic acid becoming thereby sometimes a base and sometimes an acid. The principal varieties of manganese found in nature are of the following descriptions:

1st. Hausmannite has the form of a four-sided pyramidal crystal, with hardness 5, and a specific gr[illegible]y 4·7.

2d. Braunite is an anhydrous sesquiox[illegible] rystallizes in an octahedron, is much harder than the [illegible] nd has a higher specific gravity.

3d. Psilomelane, generally called [illegible] t gray oxide, occurs in botryoidal and stalactitic sh[illegible]

4th. Manganite is a hydrous sesqu[illegible] lizes in right rhombic prisms.

5th. Pyrolusite, the most useful and abundant ore of manganese, derives its name from two Greek words signifying "fire" and "to wash", in allusion to its property of discharging the brown and green tints of glass; it crystallizes in small rectangular prisms, or is fibrous, radiated, and divergent, of iron black color and grayish streak, has a specific gravity of 4·94, and is composed of 37 per cent oxygen and 63 per cent manganese. This ore is generally called binoxide, deutoxide, or peroxide, is a good conductor of electricity, and strongly electro-negative in the voltaic circuit. When heated to redness it readily parts with its excess of oxygen as it gives off one third of it. When heated with sulphuric acid one half of its oxygen escapes. Owing to this property it is more employed in the arts than any other oxide; it is called in trade the "black oxide of manganese." Its commercial value is dependant upon the proportion of oxygen which it contains in excess of that which is necessary to its existence as sesquioxide. A convenient method of estimating this excess of oxygen is founded upon the circumstance, that the black oxide of manganese is decomposed in the presence of oxalic acid, and from sulphuric acid proto-sulphate of manganese is formed, and all the excess of oxygen reacts upon the oxalic acid and converts it into carbonic acid which passes off with effervescence. If the mixture be weighed before the decomposition has been effected, and again after it has been completed, the loss will indicate the amount of carbonic acid; each equivalent of peroxide of manganese gives two equivalents or its own weight of carbonic acid.

Manganic acid is known under the name of chameleon mineral, is obtained artificially by fusing the peroxide of manganese with equal weights of caustic potash, which when dissolved in a small quantity of water has a green color, but when largely diluted becomes purple and ultimately claret color; for this property it has been employed for many years in the arts.

Permanganic acid is artificially obtained by mixing intimately four parts of finely powdered peroxide of manganese with three and one half parts of chlorate of potash, while five parts of hydrate of potash are dissolved in a small quantity of water and added to the above mixture, the whole is evaporated and reduced to powder, then heated to dull redness for an hour in an earthen crucible and when cold the mass is treated with water and filtered through a funnel plugged with asbestos; the solution after being neutralized with sulphuric acid yields on evaporation beautiful red acicular crystals of permanganate of potash. This preparation of later years has become an important vehicle for disinfection. Among the other native oxides of manganese may be mentioned the *mineral wad* which is also very abundant but not valuable enough to produce gas. It is amorphous, soft, black, or brown and purple; when mixed with linseed oil it produces spontaneous combustion. It is supposed to be the coloring ingredient of the dendritic delineations upon many substances, such a steatite and others mentioned elsewhere. The localities of manganese are very prolific; pyrolusite has been mined very extensively in Europe; psilomelan in England, France, Belgium, and the United States; manganite in Bohemia, Saxony, and England. Much of the latter is consumed in the bleacheries of those countries. The United States and the Provinces have inexhaustible deposits of the oxides of manganese. From Vermont, the eastern limit, to Georgia, the southern limit, large supplies were formerly furnished, but in late years West Virginia, North Carolina, and California have supplied us to a large extent but not of a high grade of oxidation. While the binoxide of manganese suitable for the manufactures ought to yield from 80 to 90 per cent of oxygen gas, the product of the last mentioned States has not exceeded 50 to 70 per cent oxygen. The provinces of New Brunswick and Nova Scotia have produced within a few years very superior oxides of manganese, and the specimens I possess in my cabinet excel in richness and beauty those from Ilmuran in Thuringen and Ihlefeld in the Hartz mountains of days gone by. The manufacturers of bleaching powders in England have for the last twenty years been supplied by the little principality of Nassau to the amount of fifty thousand tuns per annum, while the United States with all its inexhaustible resources has not exported any, and it is hoped that before long the export of manganese may prove lucrative. The quality of the Nova Scotia manganese is, according to Howe, of high per centage, some from 82·4 to 89·8 of sesquioxide, and that from Tennycape as high as 97·04. The international manganese mine of New Brunswick contains from 80 to 85 per cent of sesquioxide. We find manganese in the State of Missouri containing much cobalt, while the Vermont manganese is associated with much iron. We also find in California, in the red hill of the bay facing the city of San Francisco, containing millions of tuns of psilomelane or compact manganese yielding from 40 to 50 per cent sesquioxide. We also know manganese to be abundant in Canada. A vein of 50 to 60 feet wide is said to exist at Bachawanning Bay on Lake Superior.

The geological position of manganese is not quite accurately known. In Germany it traverses porphyry and is associated with calcspar and baryta. In Vermont, in the United States, it is found among crystalline rocks; in Canada it is accompanied by dolomite, and in Nova Scotia it exists in a gray limestone, quartzite, and conglomerite, and it unquestionably belongs to the new red sandstone formation. My manganese mines at Pembroke are situated close to the gypsum deposits, which would range them with the upper silurian system.

I will now enumerate the many useful applications in the arts.

1st. Manganese is employed for producing oxygen gas in the chemical laboratory, the material of the compound blow pipe and drummond light, for the production of alkaline manganate in order to procure a good and cheap light in combination with coal gas.

2d. Manganese is most extensively used in the manufacture of chlorine so as to prepare a bleaching liquid or powder, the consumption of which by the paper and cotton manufacturers is unlimited.

3d. Next in importance is the manganese largely employed in the green flint glass works in precipitating the iron, and when added in excess to produce an amythyst color in flint glass.

4th. Steel manufacturers require manganese for producing a hard and tough product; a half pound to fifty of iron will have the effect.

5th. Linseed oil is rendered more siccative by the addition of manganese, and is called a patent dryer for paints and varnishes.

6th. A permanent black on earthenware and pottery is obtained by exposure to heat.

7th. A black enamel used in ornaments by jewelers is likewise produced with manganese.

8th. The manufacture of permanganates, a powerful disinfectant, and the main material in the new oxygen light is obtained from the same.

9th. The quality of spirits, with or without distillation, is obtained by the use of maganese.

10th. The chameleon mineral used in sugar refining is prepared with manganese.

The consumption of manganese for the manufacture of the new gas light about to be introduced in this country, forms a new epoch in this direction. It is to be converted first into the alkaline manganate, which acting as a sponge alternately absorbing the oxygen of the air and again releasing it, must require if successful, not less than one hundred thousand tuns of manganese in order to produce a million of cubic feet of oxygen gas, and I gather the following particulars from the programme issued by the inventors, Messrs. Tessie de Motay and Marechal of Metz: "The manganates are decomposed at a temperature of 600 deg. Fah., by the action of a jet of ordinary steam which liberates the oxygen and leaves a residuum composed of sesquioxide of manganese and the alkaline base contained in the combination. The manganate is regenerated by submitting the above mentioned solid residue to the action of a current of air at the same temperature as used in the decomposition, and all these operations are conducted in a series of retorts placed in a furnace where the manganates, after being raised to a temperature of 600 deg. Fah., are alternately submitted to the action of a jet of steam and current of air which restores to the mass the oxygen has lost. The oxygen is disengaged by the steam from retorts; this steam is liquified by pressing into a condenser, and the pure oxide is collected into a gasometer. When applied for the production of light, oxygen in combination with common coal gas permits a reduction in the consumption of the latter, but at the same time giving an equal quantity of light in the proportion of 16 to 1.

The permanganate of potash or Condy's disinfectant is recommended as a powerful agent in obtaining pure drinking water and in epidemic diseases. But by far the largest amount of manganese is consumed by the manufacturer of bleaching powders. England alone consumes 80,000 tuns for that purpose per annum, and as soon as the United States becomes independent of the English imported chloride of lime for bleaching the cottons and the papers, not less than one half million tuns will be consumed for the desired object, for on examining the report of the director of the bureau of statistics, I find that 12,682 tuns of bleaching powder have been imported the first five months of the year at the value of $324,066.

NOTES ON THE VELOCIPEDE.

Our exchanges teem with items of all sorts concerning the velocipede. We are also in receipt of many letters of inquiry and suggestion with reference to the construction of the machine, some of them unpractical, others containing useful hints. One correspondent suggests the making of a vulcanized rubber rim to velocipede wheels, so that they could be run over Belgian pavements without shock to the rider, and the propeller wheel could also gain superior tractive power. Some very ingenious and peculiar devices are now on their way through the Patent Office, and will, if successful, make this little iron horse "a horse of another color," if we mistake not in our predictions.

A lady, writing from Georgia, wishes manufacturers to take into special consideration the wants of ladies. She says that the awkward position they are now forced to assume astride the front wheel, is a serious objection. She suggests a velocipede for two persons. It might have seats something like a side-saddle facing in opposite directions and be propelled by the combined power of the two riders, each on her own side of the wheel. This suggestion is worthy consideration, but, for our own part, we don't think it would work well with two female riders. There can be no doubt, however, that good sport could be had by a gentlemen and lady on a machine of such construction.

As is the case with almost every new invention, there are those who wish to make out that it is a discarded experiment of the past; but we do not believe the velocipede of the past could compare either in principle or nicety of construction with the two-wheeled machine of the present.

We have in our office a colored engraving of the velocipede of 1819, described in an English journal as follows:

This machine was of the most simple kind supported by two light wheels running on the same line; the front wheel turning on a pivot which, by means of a short lever, gave the direction in turning to one side or the other, the hind wheel always running in one direction. The rider mounted it and seated himself in a saddle conveniently fixed on the back of the horse (if allowed to be called so), and placed in the middle between the wheels; the feet were placed flat on the ground, so that in the first step to give the machine motion the heel should be the part of the foot to touch the ground, and so on with the other foot alternately, as if walking on the heels, observing always to begin the movement very gently. In the front before the rider was placed a cushion to rest the arms on while the hands held the lever which gave direction to the machine, as also to balance it if inclining to either side when the opposite arm was pressed on the cushion.

It will be seen at once that the "little difference", in the manner of propelling this machine and the modern one, completely changes the character of the vehicle. The ridicule which assailed this machine was not without foundation; the motion in propelling it was not graceful, and it was said to give rise to numerous cases of rupture.

Not so with the velocipede of the present, which glides along as though it were alive, and with a smooth grace alike exhilarating and beautiful to behold.

An English paper gives a description of a velocipede calculated to convey from six to a dozen people. It has four wheels for carrying and propulsion, and a fifth guide wheel, which acts upon a lever or pole, and cramps two of the wheels precisely as the fore wheels of carriages are now cramped in turning. Each pair of carrying wheels is provided with double cranks which are connected with each other by longitudinal treadle bars, so that all can aid in propelling the machine. This velocipede is provided with cross seats having backs like one of our Yankee market-wagons. It has not been tried yet, but it is stated that a club is being organized to manipulate it.

Performances with them are coming into fashion at the theaters. In the Parisian theatrical world considerable sensation has been caused by velocipede performances, and even some curious acrobatic exercises are gone through with them. A notice in the Paris journals recently stated that not more than twelve velocipedes should be allowed "at one time" on the stage. Chicago has followed suit, and the habitues of Crosby's Opera House have been treated to velocipede exhibitions between the other portions of the entertainment.

There also was a velocipede race at Pike's Music Hall in Cincinnati recently. A silver cup worth $100 was given to the fastest rider, and another, also worth $100 to the slowest rider

An exchange says, that a day or two since, a certain gentleman in Chicago, who has been practicing for some time on the side walks, at vespertinal hours, came out upon Indiana avenue, and throwing down the gauntlet of defiance, dared a street car driver to race with him to Thirty-first street, the terminus of the track. The challenge was gallantly accepted by the car driver, although the latter had several lady passengers on board. The race began auspiciously, the horses being driven at a furious pace. The velocipede soon gained upon its competitor and bade fair to distance it when an unlucky crack in the sidewalk received the fore wheel, leaving the other, in obedience to the law of its momentum, to turn a somersault, throwing the rider into the gutter. The car won the race on a "foul."

Rural districts are catching the mania. A velocipede school has, we learn, been established in Bridgeport, Ct., but it is said that the nearest approach to a velocipede that has been seen in Danbury was a bit of orange peel, on which a citizen went across a sidewalk and down a pair of stairs in just 1½ seconds—the quickest time on record.

Winslow Homer's last drawing for *Harper's Weekly* is very original in conception. He makes the New Year come in on a velocipede!

Mr. Dana, of the *Sun*, has become, it is said, one of the most expert velocipedists in the city. It is also asserted that he advocates a project to build an elevated railway from Harlem to the Battery, to be used only by the riders of velocipedes. By this means it would be possible to go from one end of Manhattan Island to the other in about an hour, making allowance for delays from stoppage and accidents. A good rider, with a clear track, would easily accomplish the distance in half an hour; but, with a well-filled road, progress would necessarily be slower. The proposed roadway ought to be at least thirty feet wide, upon an iron framework; with a flooring of hard pine. By all means let us have the "elevated roadway," and let the sidewalks be kept clear for pedestrians, who are otherwise likely to be endangered by the carelessness or awkwardness of velocipedists.

We regret to record that the Park Commissioners have prohibited velocipedes in the Park. The reason assigned is that the drives are narrow and horses are likely to become frightened. Then, why, Messrs. Commissioners, do you not widen the drives without delay? The Park was made for the public not the public for the Park. The drives are too narrow, anyway, especially on the east side of the Reservoir, and as we believe it is intended to widen them, we do not see good cause for postponing the work. As to frightening horses the following, from a correspondent of the *Herald*, is practical and suggestive:

The *Herald* is right. Velocipedes ought to be admitted to the Park. And why not? In the year 1855 I spent nearly four months in Paris, and occasionally saw velocipedes passing rapidly through the Champs Elysees and along the boulevards without exciting much attention either from man or beast. The horses did not appear to notice them at all. I was in Paris again last spring and found the velocipede mania raging with considerable force, and these vehicles were commonly to be seen upon the most frequented streets and public places of the city. The horses were not afraid of them. Yet, if you will allow me to say so, I am not quite sure that this state of things would hold good in our parks. It is noticed by all travelers that a runaway is a rare occurrence in Paris. Indeed, this remark holds good respecting all other cities in Europe. I have spent nearly two years of my life in Europe, and in all that time I never saw a horse run away. On my first visit to the Park after my return, in June last, I saw the fragments of no less than three light geared, heavy top buggies scattered along the roadway, and it is not uncommon, I am told, to have ten or fifteen injured persons brought in on a single day to St. Luke's Hospital, victims of smash-ups in the Park.

There is something radically wrong either in our driving or in our system of breaking horses. Probably both are faulty. And here, I suggest, is a subject for a searching inquiry.

Adulterations in Tea and Coffee.

The New York *World* has been applying its editorial nose to the tea chests and coffee bags, as well as the whisky barrels of New York, and finds much to offend. It says:

We heard, not long ago of one of the great tea houses buying in a cargo of damaged tea from a vessel which sunk in the harbor. It was properly doctored and fixed up, and put into the market afterwards. A common adulterant of genuine teas is exhausted tea leaves. A few years ago there were eight manufactories for the purpose of re-drying exhausted tea leaves in London, and several others in various parts of the country. The practice pursued was as follows: Persons were employed to buy up the exhausted leaves at hotels, coffee houses and other places at 2 1-2d. to 3d. per pound. These were taken to the factories, mixed with a solution of gum, and re-dried. After this the dried leaves, if for black tea, were mixed with rose pink and blacklead, to "face" them, as it is termed by the trade. The same practice is pursued in this country.

Perhaps the most general mode of adulterating the better grades of coffee in New York is by the admixture of inferior coffee. The Java is, of course, rich and comparatively expensive. The common South American coffee is cheap, has a flat aroma, and a bitter taste. When the berry is burnt it cannot be readily distinguished from the Java berry, and, of course, identification is lost after grinding takes place. We are informed that a new adulterant has been discovered in sweet potatoes, and that it is becoming quite popular with the sellers of ground coffee. It has the right color and taste, and it is not easily detected without the microscope. The common adulterant for coffee, however, is chicory. The use of chicory is openly acknowledged in some places, and even defended by grocers on the score of health and economy.

We have medical testimony that chicory is extremely injurious to health. Dr. Hassall says that taken constantly, prolonged and frequent use produces heartburn, cramp in the stomach, loss of appetite, acidity in the mouth, constipation with intermittent diarrhea, weakness in the limbs, trembling, sleeplessness, a drunken cloudiness of the senses, etc. Again, it is the opinion of an eminent oculist in Vienna, Professor Beer, that the continual use of chicory seriously affects the nervous system, and gives rise to blindness from *amaurosis*. Its use ought, therefore, to be discouraged, and grocers who sell it for coffee ought doubly to be put under the ban.

An Earthquake Convention.

A convention called by joint committee, on the Investigation of Earthquakes, has heen held in San Francisco, with a view to the adoption of an improved system of building and other precautions against future disaster from earthquakes. The following report of its proceedings is from the *Bulletin*:

Mr. Gordon explained that the laboring oar in the investigation must fall on the two secretaries, and gentlemen had been selected having peculiar qualifications for the position, and who could give their entire time to the business in hand. Professor Rowlandson would bring the experience and critical knowledge of a man of science, and Mr. Bridge, a practical architect and builder, a vast fund of information in relation to investigations and experiments with mortars, cements, etc., gained while with General Gilmore, United States army.

The President called for reports from the sub-committee No. 1, on bricks, stone, and timber.

General Alexander, chairman, reported that the committee had made some preliminary investigations as to the qualities of brick, and had put on foot inquiries as to the properties of brick made mostly from sand, which had been highly spoken of in the Eastern States. He had no hesitation in saying that, as a rule, the brick used in the city were not good. Better brick can be made with the same material by using proper proportions and knowledge in burning, etc. He cited from his own experience a case in point, where a large kiln of brick had been condemned as defective, and from the same material, under his supervision, a very superior article had been made; the difference being in proportions and in burning.

Sub-committee No. 2. on Limes, Cements, Mortars, etc., Colonel Mendel, chairman, reported that they had the matter in progress, but were not prepared to make any extended report. Granted further time.

Sub-committee No. 3, on Structural Designs, General Alexander, chairman, reported progress from the committee, who were granted further time.

The President made some incidental remarks on the advisability of recommending some plan by which structures already erected can be strengthened by iron bracing, to resist any subsequent shocks, instancing the plan he was adopting in bracing the sugar refinery, etc. The matter was discussed by General Alexander, Colonel von Schmidt, Dr. Blake, and Judge Rix. On motion of Mr. Rix the matter was referred to the Committee on Structural Designs.

Sub-committee No. 4, on Scientific Inquiry, etc., Dr. James Blake, chairman, reported that the committee had met, and the investigations had been commenced. In this connection a letter was read by General Alexander from R. C. Hopkins, Custodian of the Spanish Archives in the Surveyor-General's office, stating that the archives were at the disposition of the committee in any investigation they might wish to make, and offering his services as translator, etc. The matter was referred to the same committee.

A discussion followed on the value of these old records on the subject under consideration. From remarks made by Prof. Rowlandson, it appeared that the old Mission records had been pretty well searched by Dr. Trask, Dr. Tuthill, and others. Mr. Hittell, of the *Alta*, stated that he had personally inspected these old manuscripts, with this very object in view, and found them very meager and unsatisfactory. On motion of Major Elliot, Colonel Williamson, United States Engineer, was placed on the Committee on Scientific Inquiry.

A letter was received from W. Frank Stewart of San Jose, accepting the invitation to serve on this committee. On motion, the gathering of facts connected with the earthquake in the vicinity of San Jose, was intrusted to Mr. Stewart.

FOOD REQUIRED TO SUSTAIN LIFE.—Judging from the minimum quantities of food upon which an ordinary individual is capable of existing without suffering in health, it would seem that about 4,100 grains of carbon and 190 grains of nitrogen are required in his daily diet. These proportions have been determined from a large number of observations, as by those of Dr. Lyon Playfair, in his inquiries into the dietaries of hospitals, prisons, and workhouses, and by those of Dr. Edward Smith, in his examination of the amounts of food upon which the Lancashire operatives were capable of living during the cotton famine, and also by his inquiries into the dietaries of indoor laborers.

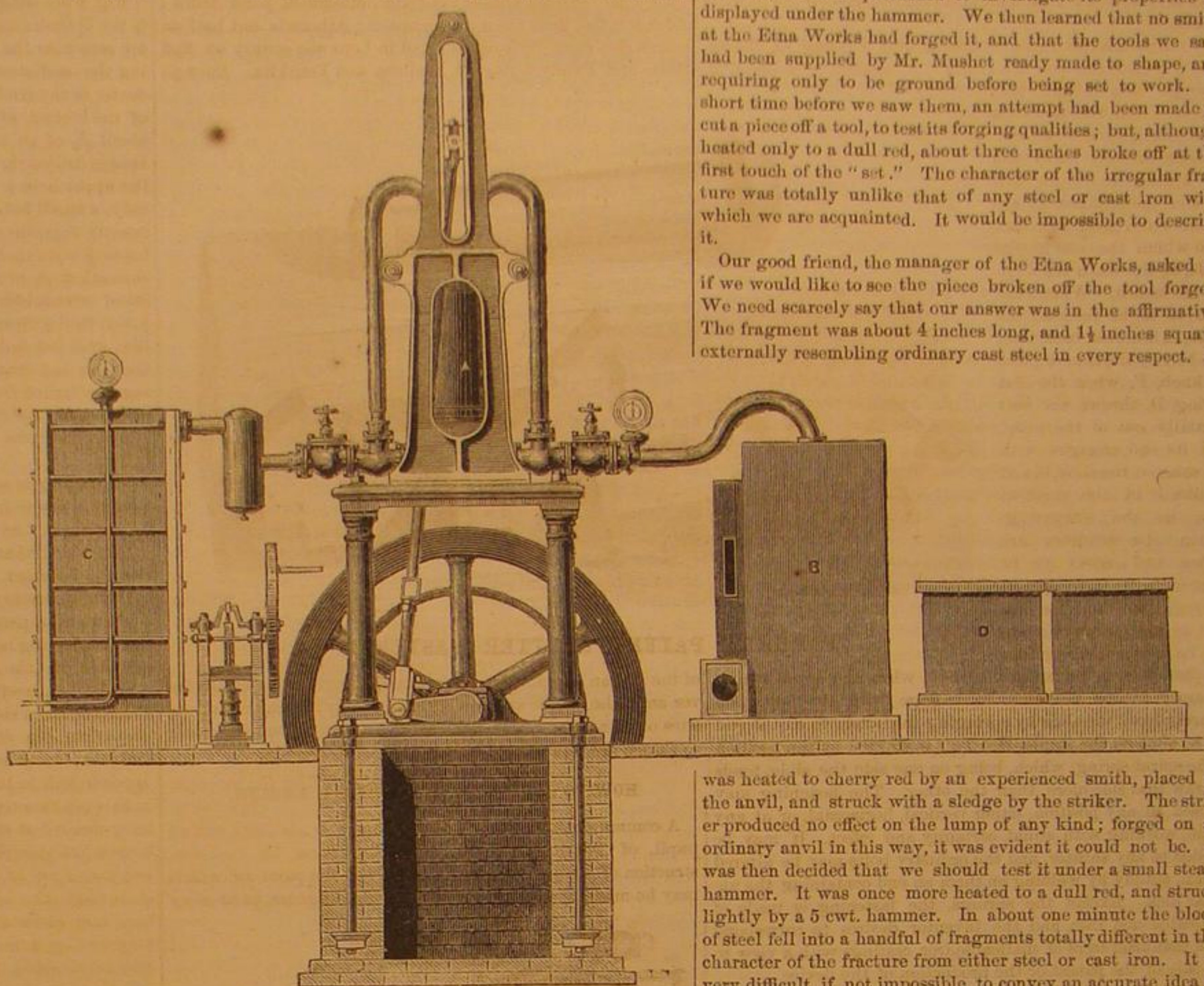
English Ice Making Machine.

We copy from the London *Engineering* the illustration of a device for producing ice, or for cooling liquids, by the evaporation of a volatile liquid under low pressue or in a vacuum.

We copy from *Engineering*: Referring to the engraving, A, is the double-acting air pump; B, the refrigerator; C, the condenser; and D, the ice troughs. The refrigerator, B, may be described as a kind of vertical multitubular boiler, the tubes of which are, when the machine is employed for ice making, traversed by a stream of strong brine, this brine being replaced, when the machine is used for cooling only by the water which is to be cooled. The tubes are of thin copper, and are of small diameter, whilst by an arrangement of diaphragms the water or brine is made to traverse the length of the refrigerator several times. The liquid ether from the condenser is admitted to the lower end of the refrigerator, and, in consequence of the vacuum formed by the air pump, it there evaporates, absorbing heat from the brine or water. The vapor arising from the evaporation of the ether is drawn off by the air pump from the top of the refrigerator and transferred to the condenser, which consists merely of a coil of pipe inclosed in a wooden tank containing water. In the condenser the ether vapor, which has become heated by its compression, parts with its heat and becomes liquefied, the liquid ether thus obtained being, as we have said, transferred through a pipe back again to the refrigerator for re-evaporation.

The machine is used sometimes for ice making and sometimes for cooling the water used in ordinary refrigerators on the establishment, and it is for the latter purpose that it can be used most economically, as we shall show presently. The air pump of the machine is 20 in. in diameter with a stroke of 37 in., and it is driven by a 15-horse non-condensing horizontal engine at a speed of 40 double strokes per minute. The general arrangement of the air pump is, as will be seen by our engraving, similar to that of a table engine, the cylinder being placed in a vertical position on an entablature, beneath which the crank shaft, by which the machine is driven, is situated. The smallest practicable amount of clearance is allowed between the piston of the pump at the ends of the stroke and the cylinder covers, and every care is taken to arrange the valves so that the capacity of the waste space which the pump is unable to clear of vapor at each stroke is reduced to the smallest possible amount. So well has this been done, that the pump is capable of producing a vacuum of 29 in. of mercury; but the vacuum which ordinarily exists in the refrigerator, when the machine is in regular use for ice making, averages 26 in. of mercury, and that when the machine is cooling water only about 20 in. The difference between the two pressures last mentioned is due to the fact that, when the machine is employed for ice making, the ether vapor in the refrigerator falls to a much lower temperature than when the apparatus is used for cooling water only, and this being the case its tension is also less. Thus, when ice making is going on, the brine passing through the refrigerator is cooled down to from 10° to 18° Fahr., and is, in fact, returned to the refrigerator to be cooled when at a temperature of 32°; whilst, when water only is being cooled, the temperature does not fall below about 39° or 40° Fahr.

The pressure in the condenser varies from 2 lb. to 3 lb. per square inch, according to the supply and temperature of the water used for condensing purposes. With an abundant supply of water, the pressure in the condenser would, when the machine was ice making, be practically nothing; but the existence of a slight pressure in no way interferes with the working of the machine, but merely throws a little extra work on the pump. It may be noticed here, as a distinctive feature of Messrs. Siebe's machine as compared with the refrigerating machines acting by the expansion of compressed air, or by alternate production and liquefaction of ammoniacal gas, that no parts of the apparatus are subjected to severe pressure. The 2 lb. or 3 lb. pressure per square inch in the condenser may be considered to be practically nothing, whilst the refrigerator is subjected to a collapsing pressure only, and that, of course, cannot exceed, however nearly it may approach, the pressure of the atmosphere. With such low pressures as these, there is, of course, no difficulty, by the aid of good workmanship, in making all joints perfectly tight, and thus guarding against loss of ether. As the heat generated by the compression of the ether vapor is considerable, the stuffing box through which the piston rod passes is kept cool by jets of water, and similar means are employed to cool the delivery valves.



SEIBE BROTHERS' REFRIGERATING MACHINE.

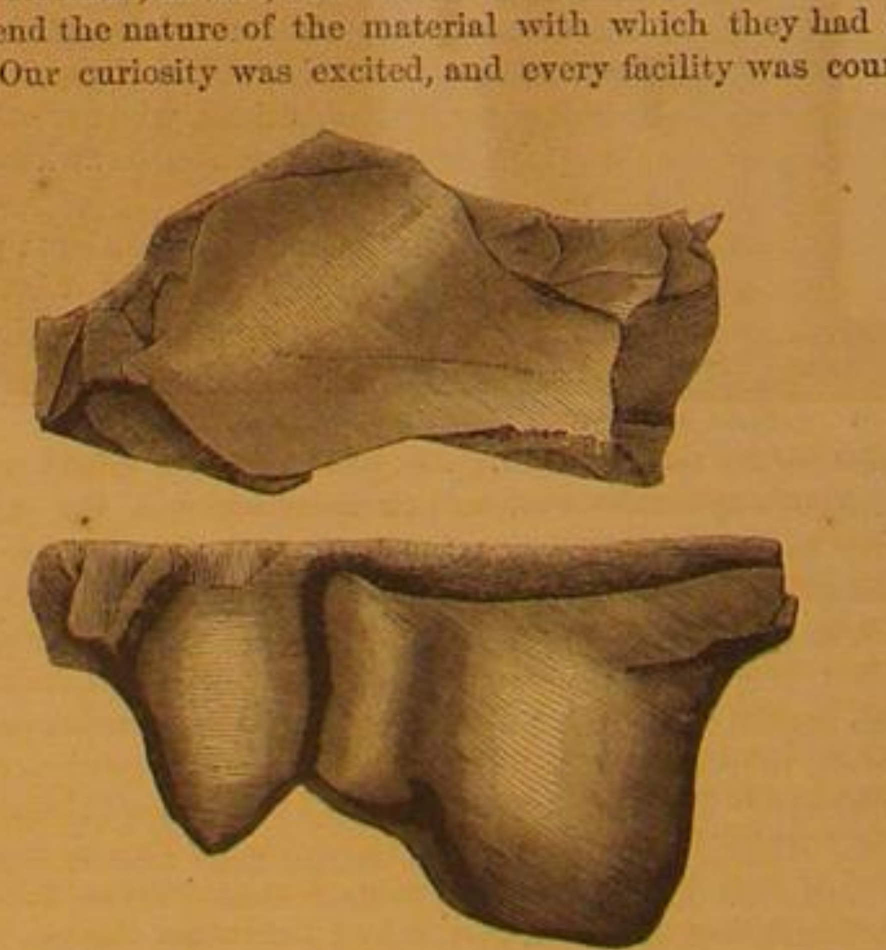
SOMETHING NEW IN STEEL.

It has long been a disputed point where steel leaves off and wrought iron begins; but it is generally received that the difference between steel and cast iron is so great that no doubt can exist as to which is which. Within the week we have proved to our own satisfaction that it is just as difficult to distinguish between cast iron and steel, as it is to define those characteristics in which steel differs from wrought iron. There is, indeed, at this moment, a so-called steel in the market, which possesses such extraordinary attributes, that the metallurgist may well feel in doubt under what head it should be classed. To all intents and purposes it is a new material, and as such it claims the attention of our readers.

For some time past Mr. Mushet has advertised a "special tool steel" warranted to last—we are afraid to say how much longer than any other steel, worked in the same way and in the same shape. Our readers may have seen these advertisements, and passed them over as legitimate trade puffs. In this they were wrong. The material—be it steel, cast iron, or some alloy—is, in reality, one of the most singular substances we have ever met with, and it possesses qualities which deserve the attention, not only of engineers, but of analytical metallurgists. We propose to put our readers in possession of all that we know about it, leaving them to draw their own conclusions, and trusting that Mr. Mushet will supply more information to the scientific public than he has hitherto thought proper to furnish to purchasers.

A few days since we visited what we shall term the Etna Works. Chatting with the manager about things in general and engineering in particular, the subject of tool steel turned up, and we then learned that a couple of tire turning tools, made of Mr. Mushet's tool steel, were in use at the moment, which we were assured possessed such qualilies, that managers, foreman, smiths, and turners were alike at a loss to comprehend the nature of the material with which they had to do. Our curiosity was excited, and every facility was courteously afforded us for testing the steel. Mr. Mushet issues with each bar printed instructions as to the system to be adopted in working it. In the first place we are told that, after forging or otherwise working the tool steel, it is to be suffered to cool slowly, and under no circumstances to be quenched and tempered. Now, it is well known that the hardest ordinary cast steel may be softened so much by heating it to a bright red and suffering it to cool slowly, that it will not retain a sharp edge for two minutes. In other words, its temper may be drawn. We proved, on the other hand, that the temper of Mr. Mushet's "special tool steel" cannot be drawn. After being heated red hot and suffered to cool slowly, it still remained harder than any ordinary cast steel tempered at straw color. The proof of this lies in the fact that a tool of the best ordinary cast steel required to be ground three times in planing a given area of hard cast iron, whereas a tool of Mr. Mushet's steel not only planed a similar area without regrinding, but remained to all intents and purposes nearly as sharp as when it began. It is rather more brittle than ordinary steel, in so far that a different angle, slightly more obtuse than that commonly employed, must be given to turning tools, but it certainly is not objectionably brittle. In the shape of chisels, we have no experience of its qualities whatever.

Having satisfied ourselves of its good qualities in the shape of a tool, we next proceeded to investigate its properties as displayed under the hammer. We then learned that no smith at the Etna Works had forged it, and that the tools we saw had been supplied by Mr. Mushet ready made to shape, and requiring only to be ground before being set to work. A short time before we saw them, an attempt had been made to cut a piece off a tool, to test its forging qualities; but, although heated only to a dull red, about three inches broke off at the first touch of the "set." The character of the irregular fracture was totally unlike that of any steel or cast iron with which we are acquainted. It would be impossible to describe it.



Our good friend, the manager of the Etna Works, asked us if we would like to see the piece broken off the tool forged. We need scarcely say that our answer was in the affirmative. The fragment was about 4 inches long, and 1¼ inches square, externally resembling ordinary cast steel in every respect. It was heated to cherry red by an experienced smith, placed on the anvil, and struck with a sledge by the striker. The striker produced no effect on the lump of any kind; forged on an ordinary anvil in this way, it was evident it could not be. It was then decided that we should test it under a small steam hammer. It was once more heated to a dull red, and struck lightly by a 5 cwt. hammer. In about one minute the block of steel fell into a handful of fragments totally different in the character of the fracture from either steel or cast iron. It is very difficult, if not impossible, to convey an accurate idea of the appearance of the fragments. The foregoing engraving of two fragments, natural size, will suffice, at least, to show that they in no way resemble fragments of ordinary cast steel broken up in the same way. The real pieces lie before us, and resemble nothing in the world so much as bits of vitreous slag from a blast furnace. They are not like any metal in the slightest degree, but on filing them the surface assumes the character of polished steel. All the pieces manifested the same conchoidal fracture. In a second experiment with another piece a far higher temperature was imparted to the metal, and it was then drawn with little difficulty to about a quarter of an inch square. It was hardened in the usual way, and did not fly, so that it is possible that in small masses it will bear hardening. The little piece is so intensely hard that no file will touch it. A lump of the same steel an inch and a quarter square cracked in all directions when heated and quenched.

What is this material? Is it steel or cast iron? Under the hammer it behaves more like cast iron than anything else; as a tool it behaves as neither cast iron or steel ever behaved before. To all intents and purposes it is a new metal. Mr. Mushet has not patented its mode of production, which he reserves as a secret. That it contains an enormous quantity of carbon is, in a sense, proved by its hardness. Why does not this carbon render it as brittle as cast iron? Is the carbon combined or graphitic? Is the "steel" simply an alloy of iron with some other metal? What is the proper method of forging it in ordinary smith's fires? These and some other questions present themselves for solution. The only conclusion we can arrive at, and we confess we do not believe it to be the correct solution of an interesting problem, is that Mr. Mushet first forges his tools or bars from a hard cast steel of the ordinary kind, and then, by some process such as recementation, imparts an additional hardness to them, which, although it makes the tool as such invaluable, renders the bar from which tools should be made, as such, useless in the hands of all but first rate smiths.—*The Engineer*.

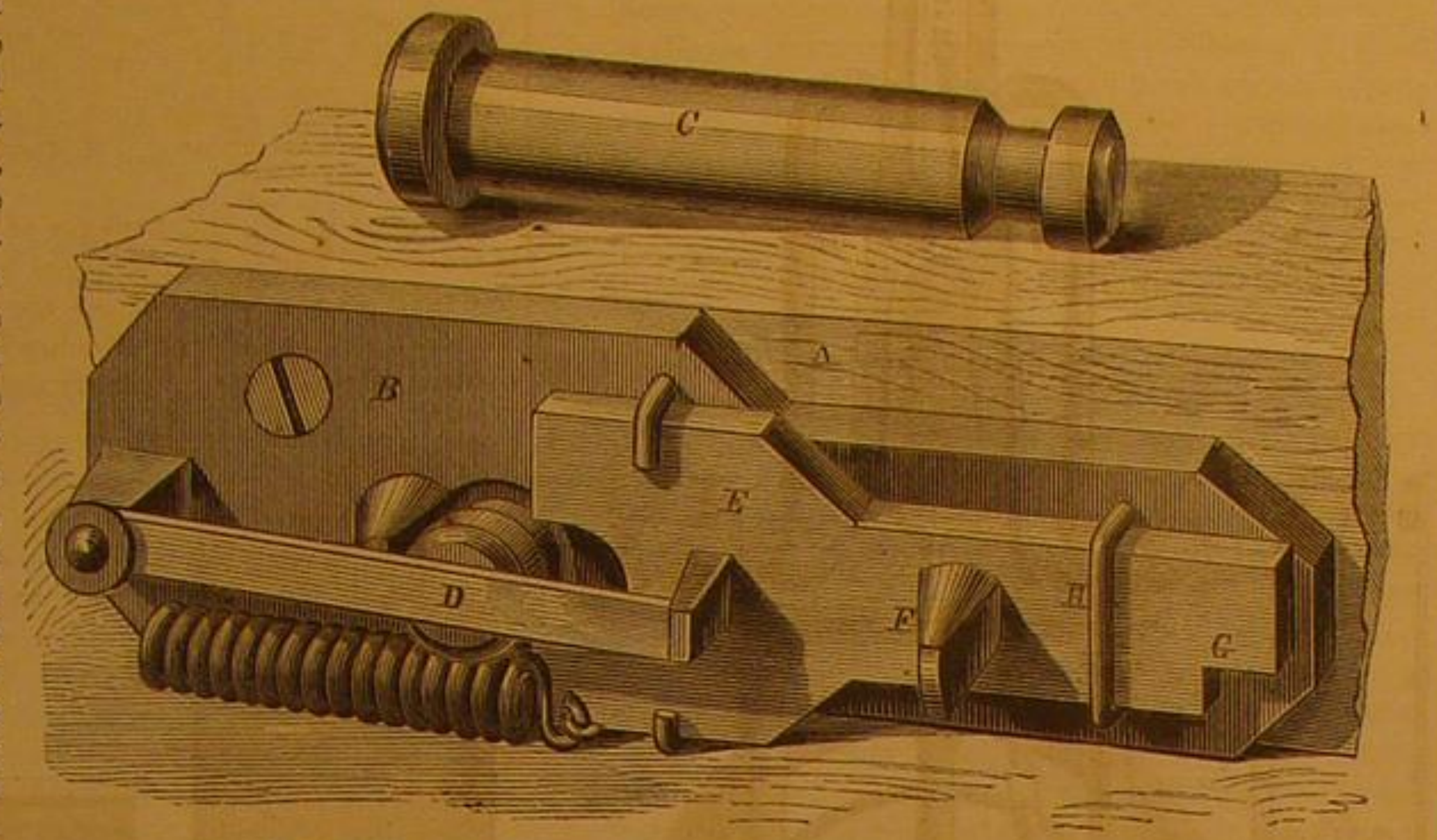
DYEING AND COLORING.—We invite attention to the article on another page written for the SCIENTIFIC AMERICAN, by the well known Dr. M. Reimann, of Berlin, author of a valuable work on "Aniline and Aniline Colors." We hope during the year to publish several articles from his pen.

IT is said that the largest distillery in the United States has just been finished near Lexington, Ky. It will be able to make 2,400 gallons of whisky per day. Thirty other distilleries in the same district will begin operations January 1st, and their aggregate daily product is estimated at 25,000 gallons.

Improved Bolt for Securing Window Shutters.

The ordinary method of locking the shutters of buildings is to pass the bolt through from the outside and then secure it on the inside by means of a strap or split key passed through a holé in the bolt near the end. Beside the annoyance of being compelled to pass into the building to lock the bolt, it is an unsafe contrivance, as sometimes by turning the bolt from the outside the key will drop out, and in any case the key is too slender to resist any considerable strain upon it from the outside before breaking. The device, however, shown in the accompanying illustration has none of these objections, and is in all respects a most admirable contrivance for the purpose intended.

A represents the wall or casement of a building, on the inside of which the lock is secured. It consists of a plate, B, through which the bolt passes. The bolt is shown detached at C, and the end is seen directly under the flat spring at D. As will be seen the bolt has an annular score near the end, into which the end of the slide, E, fits when the shutter is locked. When the bolt is to be released the slide, E, is moved back from the bolt by the thumb piece or knob, F, when the flat spring, D, throws the bolt partially out of the plate, and its end engages with the snug on the slide, E, and retains it in the position seen in the engraving. When the shutters are closed and ready to be locked, the bolt is passed through from from the outside in the ordinary manner, its end pressing against the flat spring, releasing the slide, when the spiral spring instantly brings the slide to engage with the bolt, and securely locks the slide by springing the notch, G, on the end of the slide on the staple, H. This is effected by the position of the spiral spring, which, being on one side the slide, tends to draw that side more than the other. The fastening may be used in any position, either vertical, horizontal, or at any angle, working with equal certainty and effect. It may be applied to any shutter, and the ordinary bolts may be altered to suit, simply by welding on them an end containing the annular nick. Except the springs, the fastening is made of malleable cast iron, and the inventor desires to correspond with manufacturers of malleable iron castings with a view to the sale of the patent or the production of the device.



FARRAR'S PATENT SHUTTER FASTENER.

Patented through the Scientific American Patent Agency, December 8, 1868, by W. B. Farrar, who may be addressed at Greensborough, N. C.

Vienna White Bread.

Prof. Horsford gives the following recipe for making the celebrated Vienna white bread: In the first place, great care is taken in the preparation of the flour. Scrupulous neatness and cleanliness are observed in all the processes of preparing the yeast and dough. The dough is placed in an oven somewhat of the type of the aerotherme, that is surrounded by currents of heated air, maintaining a uniform temperature of about 380°. By an arrangement of steam pipes, jets of steam are introduced into the oven to maintain an atmosphere saturated with moisture, and so retard the evaporation of water from the loaf during all the early part of the baking. When the loaf has attained its fullest distension and is penetrated by myriads of minute pores, the steam is shut off, and a side door, communicating with a separate fire from that which heats the oven, is opened. From this the heat of an intense blaze is flashed into the oven to be reflected from the low, glazed, tile roof, and give that requisite delicate red tint to the surface, which at the same time charges a thin crust with an aroma which is the product of roasting—an essential oil—most grateful to the palate. This part of the operation is brief, and is watched through a glass door. When complete the loaves are taken from the tins and immediately varnished with warm milk or water, with which a little good melted butter has been incorporated. The water of the milk quickly evaporates, and leaves a fine glazed surface.

We can testify from considerable personal experience that the Vienna bread and beer are the best to be found anywhere.

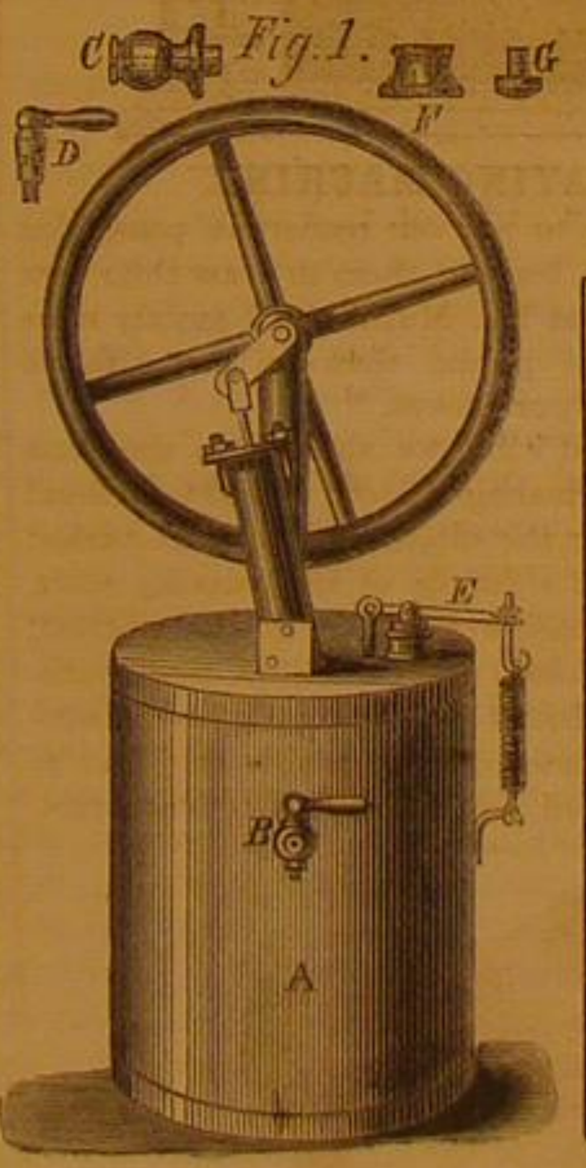
The Growth and Prosperity of Michigan.

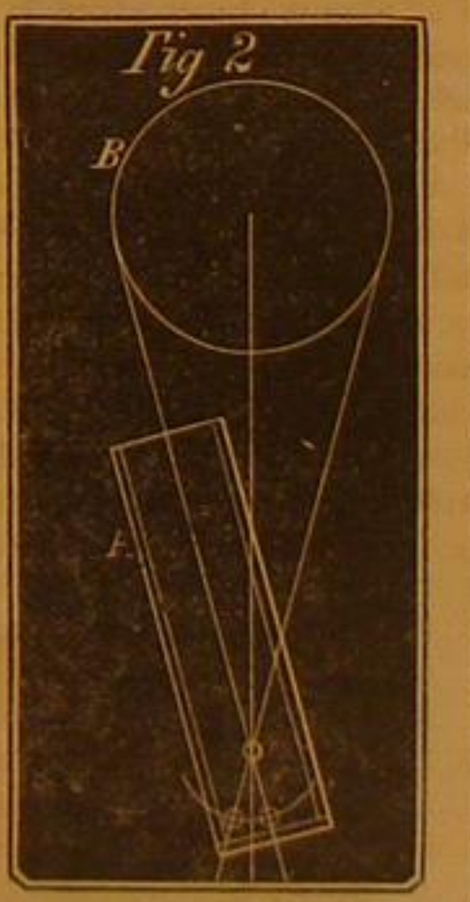
Many of our readers can remember when Michigan was in the far West, only to be reached by tedious journeyings through wide regions of unsettled country. But to-day Michigan has a population of more than a million; six incorporated colleges, one of them a University, with law, medical, literary, and scientific departments, and with more than twelve hundred students; an Asylum for the Blind and the Deaf; two Asylums for the Insane; a Normal School; high schools in every considerable town, and a system of public instruction as thorough, as wisely adjusted, and as efficient as in any State of the Union, so good indeed, that private schools are hardly known. Pupils come from all the States of the West, not only to the University, but to the Union Schools of Michigan. The finest and largest buildings, the most beautiful for situation, and most convenient in their appliances, are those which are set apart for public instruction. No interest is so jealously guarded as this. Every city and every county has its superintendent of schools. There is the same zeal for education in the newer as in the older settlements, in Saginaw and Muskegon, as in Monroe and Detroit. The market for school books in these forest cities is not less sure and regular than the market for boards and shingles.

Classic and foreign learning flourishes on what were but yesterday Indian hunting grounds; and the youths and maidens know more of Goethe and Virgil and Xenophon than of the legends of the red men. This strange mingling of ancient lore with the traditions of savage life is presented to us in the names of Michigan towns and cities. Pontiac borders upon Troy; just beyond Owasso is Ovid; Metamora joins Attica; Adrian is the next town to Tecumseh; Athens is but half an hour's ride from Wakeshma; and in Lenawee county we find Rome and Palmyra close to Madison and Franklin. Enough of the Indian appellations are retained to preserve a native flavor amid the classic and romantic names by which the famous sites of Europe and Asia, ancient and modern, from Caledonia to China, are represented in this favored Peninsula.

HOW TO CONSTRUCT A TOY STEAM ENGINE.

A communication from T. D. Quincy, Jr., a high school pupil, of Dorchester, Mass., gives directions for the construction of a toy steam engine, most of the parts of which may be made by any boy of ordinary intelligence, possessing a slight knowledge of the use of tools, at a very slight cost. It is a single acting, oscillating engine of which A, Fig. 1, is the boiler, which consists of a fruit can about 4 inches in diameter by $4\frac{1}{2}$ inches in hight, with a new end soldered on where it was opened. B, C, D, represents the gage cock, which is made by turning a piece of brass to the form indicated at C, and drilling a hole through it in the globular part, which is then reamed out tapering. The plug, D, of the cock is turned to fit the hole in C, and seated by grinding it in with grindstone grit and oil at first, and afterward with oil alone. A piece of wire will do for the handle. Cut a thread on D, and fit a nut on it to hold the plug D in C; then put the two together and drill a hole longitudinally through C and across D. The cock is then complete. It may be cheaper to purchase the cocks already made at any gas fixture or hardware establishment, but these directions are intended for those who cannot readily avail themselves of this accommodation. E is the safety valve with its parts. F shows the form of the seat of the valve which has a hole drilled through it, as seen by the dotted lines, and beveled at the top to receive the piece marked G. Place these together and seat them by grinding, as in the case of the gage cock. Make a score in the small portion of G to receive the edge of the safety valve lever. This lever is merely a light bar with a hole in each end, one end to be attached to a stud, or fulcrum secured to the top of the boiler by soldering, and the other to a light spring on the side of the boiler with an adjusting nut at the top, or it supports a hook on which weights may be suspended. These described, two of the most important points relating to the boiler may be understood—the gage for ascertaining the hight of the water; and the safety valve, the means of regulating the steam pressure.





The cylinder of the engine is a piece of brass tubing, $2\frac{1}{4}$ inches long and $\frac{1}{4}$-inch internal diameter, ground out true. The piston is a disk of brass, $\frac{1}{4}$ inch thick, with a wire soldered to its center as the piston rod. On opposite sides of the cylinder, near the top, are soldered two screwed pieces of wire designed to hold the cylinder end and stuffing box combined, in place.

Fig. 2 is a diagram of the cylinder, and its connections, A, is the cylinder, and B the path of the crank pin. Three holes are seen near the bottom of the cylinder, with an arc describing the oscillation of the cylinder, the upper hole being the center of the circle of which the arc is a segment. On the side of the bottom of the cylinder is soldered a piece of brass, about $\frac{1}{16}$ of an inch thick and $\frac{5}{8}$ by $\frac{9}{16}$ in area. The lower hole is drilled through a plate into a cylinder near its bottom; the upper hole $\frac{3}{8}$ of an inch above it and through the plate only, a small hole slightly indenting the cylinder being made exactly opposite without piercing the shell. Another piece of brass, $\frac{1}{8}$ inch thick, $\frac{5}{8}$ wide, and $\frac{3}{4}$ long, has a hole drilled through it $\frac{9}{16}$ of an inch from the bottom, and that receives a bit of wire soldered in and projecting $\frac{1}{16}$ of an inch. On a $\frac{3}{8}$-inch radius from this point, $\frac{3}{32}$ of an inch from the center line, drill two holes, that on the right hand entirely through the piece and that on the left about half way through, meeting one drilled from the bottom. The inner faces of this plate and that on the cylinder must be fitted smoothly together. These constitute the valve faces, or valve and seat of the engine.

The pillars or supports of the wheel, shaft, and crank, are rods of brass or iron, $3\frac{5}{8}$ inches high, with holes near the top for the shaft. At the hight of $\frac{9}{16}$ of an inch from the bottom a hole is drilled and tapped, through which a pointed screw is passed, the point of which enters the hole in the side of the cylinder opposite that on which the plate is soldered. The thicker and separate plate is soldered to the top of the boiler, the side having both holes being placed inward or next the cylinder, and the left hand hole meeting that through the bottom being directly over one through the top of the boiler. Place the faced side of the cylinder against the fixed plate, the projecting pin of which enters the hole in the cylinder plate and the pointed screw through the pillar engaging with the opposite hole in the side of the cylinder. The pillar is soldered in this position to the top of the boiler, and the other is similarly secured at the distance of about one inch. The cylinder bottom is a thin plate of brass soldered on. When the crank and piston are at their lowest points, the latter should not quite reach the lower hole in the cylinder. The wheel may be of iron, about $4\frac{1}{2}$ inches diameter, to be obtained at any iron foundery, or be cast of lead, or lead and tin. The gage cock may be attached $3\frac{1}{2}$ inches from the bottom, and if filled to this hight the boiler will furnish steam for half an hour's safe running. The boiler may be filled by the safety valve. To start the engine set the boiler on a stove or range, or place it over a lamp. The first is the preferable mode as being more cleanly.

An engine of this fashion need not cost much, and its construction would afford useful employment to boys in town or country, and be a source of pleasant and profitable amusement during winter evenings.

Correspondence.

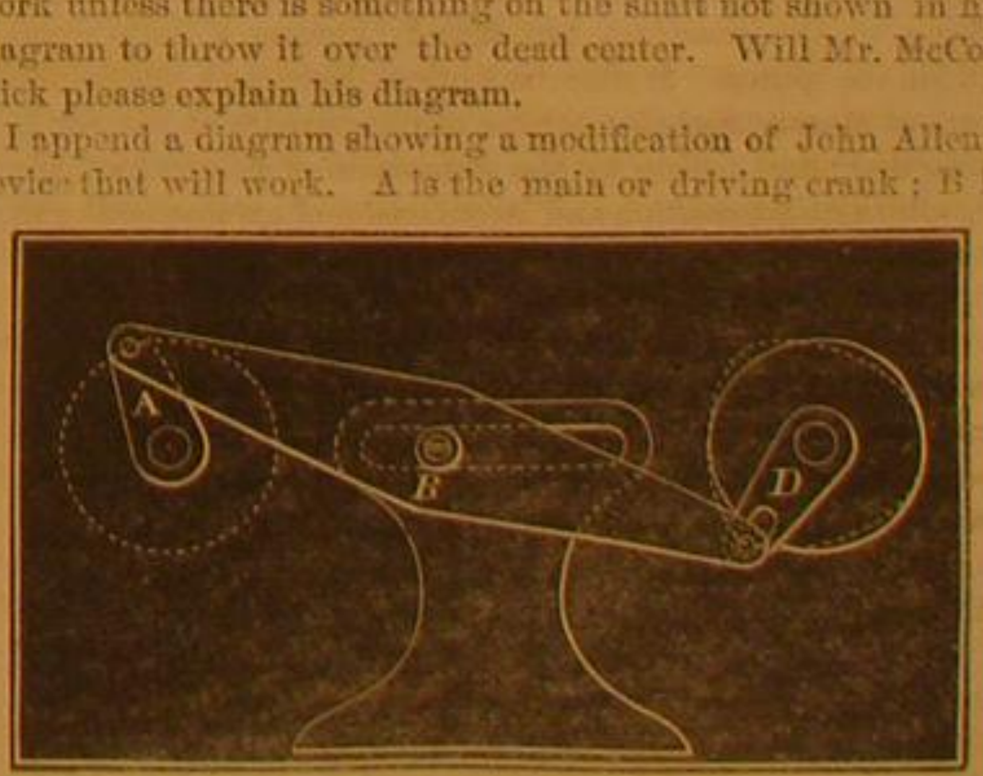
The Editors are not responsible for the Opinions expressed by their Correspondents.

Connecting Shafts by Pitmans.

Messrs. Editors:—John Allen's plan for connecting shafts by pitmans, a diagram of which is given on page 20, Vol. XIX, and which "Aberdeen," on page 69, same volume, says won't work, will not work. With a trifling alteration it will work finely.

D. H. McCormick's diagram, on page 21, Vol. XX, will not work unless there is something on the shaft not shown in his diagram to throw it over the dead center. Will Mr. McCormick please explain his diagram.

I append a diagram showing a modification of John Allen's device that will work. A is the main or driving crank; B is



the fulcrum which is made permanent in the center of the connecting bar and slides in its bearing, B, slotted for the purpose. The crank, D, is slotted at the end to allow the crank-pin to slide to and from the center. The crank pin will describe a curve shown by the dotted line E. In this way the movement will be perfectly free and smooth, though with slightly varying velocity in the revolution of the crank D.

C. H. Palmer.

Periodic Oscillations of the Earth.

Messrs. Editors:—An article in your paper indicates a theory of earthquakes and volcanoes originating from gaseous explosions as opposed to the general belief in a molten sea beneath the earth's crust, and basing the improbability of such liquefaction on the universal ruin resulting from its eruption. This theory would be more probable did the explosive force crush through "thirty miles of the earth's crust," but why the necessity of such supposition, when conduits such as volcanoes and fissures penetrating through the crust of lesser thickness relieve the pressure?

The theory of an igneous sea is probable from the increase of heat proportioned to the earth's penetration, and also from the simultaneousness of earthquakes in regions far distant. There is also the periodicity remarked in geysers, volcanoes, and earthquakes, as regular in some instances as the ebb and flow of the tidal wave. This periodic law was noticed by Professor Palmieri, of Naples, who, from large investigation, attributes the eruptions of Mount Vesuvius to lunar influences. "The periods of its greatest force are every day half an hour later, coinciding with the movements of the moon, showing that the interior of the earth is like the ocean subject to tides."

There is reason to believe that internal oscillations of the earth are as periodic as external phenomena. In deep mining, from the hours of twelve at night until eight in the morning, water falls where none is seen during the day. The volume in the wheel is perceptibly increased; the atmosphere is charged with gases which prevent lights burning, and small particles of earth and rock, as in the Chicago tunnel, are observed to fall from the tops of the drives. Similar to this is the disturbance of the Atlantic Telegraph, whose electric pulse beats slowly or rapidly in certain recurring hours.

Humboldt remarks that "the great earthquakes which interrupt the long series of slight shocks appear to have no regular period at Cumana; while on the coasts of Peru, as at Lima, a certain regularity has marked the destruction of the city. The belief of the inhabitants in that uniformity has a happy influence on public tranquility and the encouragement of industry." GEO. A. LEAKIN.

Baltimore, Md.

[The article referred to, published on page 377, Vol. XIX, SCIENTIFIC AMERICAN, propounds no unknown theory. Hutton, Mayer, and even Lyell suggest a similar theory, the latter, although giving attention and consideration to La Place's idea of the agglomeration and solidification of liquid nebulous matter, proving the growth and present formation of what are called the primitive rocks, thus striking a heavy blow at a theory which he evidently only partly accepted for want of a better. If an igneous sea existed and, as our correspondent states, "volcanoes and fissures penetrating through the crust of lesser thickness are conduits to relieve the pressure," how does he account for the total extinction of these outlets, many instances of which are patent. If the cause continues to exist why not its results be continually shown?

Our correspondent's second paragraph in regard to the simultaneousness of earthquakes could hardly be attributed to "lunar influences." Periodicity of eruptions, as geysers and volcanoes, boiling springs, etc., is no proof of the existence of a molten interior, but rather an evidence of the existence of a more superficial cause. He must have heard of, if not seen, the natural phenomenon of intermittent springs, which, are never attributed to an internal globe of liquid fire whether its perturbations are caused by lunar influence or the unequal pressure of gases evolved, but to natural syphons existing in the earth and connected with the surface at different points. That the whole earth, land as well as sea, is subject to lunar influence will not be disputed, but if this influence reaches a molten interior, there is no reason why Vesuvius and other volcanoes should not have their eruptions every thirty days, and the tremor of the earthquake follow continually the course of the moon.

The facts in the statements made in the last two paragraphs of Mr. Leakin's communication can be accounted for, as he will see, without the theory of a molten interior of the globe we live upon. What he means by the heading of his communication, "Periodic Oscillations of the Earth," we do not understand.—EDS.

Does Resistance Increase as the Square or Cube of Velocity?

MESSRS. EDITORS:—Whether the resistance of ships increases as the square or as the cube of their velocity, is a point much disputed; some maintaining the former, some the latter, and there is still another class who maintain that, while the resistance only increases as the square, the power required increases as the cube of the velocity.

The importance of a correct decision of this vexed question arises from the fact that this decision forms the only mathematical basis to any calculation required to determine the amount of power required to overcome the resistance of any vessel at any proposed increase of velocity.

The writer is of opinion, that resistance only increases as the square, and power to overcome increased resistance only increases in exact proportion to resistance, and in support of his views submits the following argument:

It is easy to prove that the resistance and the power required do not increase as the cube of the velocity by a single test. A 5,000 tun steamer uses at present 6,000 actual horse power of steam when making a speed of 15 miles per hour, hence, if resistance increases as the cube of velocity, to go one-tenth the speed would only require one-thousandth part of the power, which is equal to saying that 6-horse power would be sufficient to propel 5,000 tuns at 1½ miles per hour, which is simply impossible by any present known appliances, therefore neither resistance or power can increase as the cube of velocity; and I trust you will agree with me as to the fallacy of such an opinion. That resistance increases as the square of the velocity is the prevailing opinion of the most eminent engineers, and this view certainly seems most in accordance with the universality of Divine law; for by doubling the dimensions of any superficies or solid, we obtain four times, and not eight times the area or quantity.

The only question now left to consider is—Does the power required increase in exact ratio or a more rapid ratio than the resistance?

That it can only increase in the same ratio seems to me mathematically certain. The only means we have of measuring resistance at all is by the amount of power required to overcome it, hence it follows that the equivalent of the power is the exact measure of the resistance, and *vice versa*; therefore if it requires a power of 10 units to overcome any resistance at any given velocity, the measure of the resistance is 10 units; and by the same law if resistance is quadrupled by doubling the velocity, the measure would be 40 units, and the power required, being always the equivalent of resistance, would be also 40 units—the distance traveled being in both cases the same.

To deny this is, logically and mathematically speaking, to deny the possibility of measuring resistance at all, which is simply absurd; and I trust it will be conceded that I have demonstrated the fact, that whether the square of the velocity is or is not the exact measure of increased resistance, that the power can only increase in exact ratio to resistance, and therefore, that if resistance increases as the square of the velocity, so also does the power. Please throw some further light on this subject. MATHEMATICIAN.

New York city.

[Without assuming to decide on a point on which doctors (engineers) disagree, we will quote from a text-book that has withstood the test of criticism, and is generally acknowledged as authority on the subject of the laws governing matter. Silliman, in his "Principles of Physics," ¶ 143, pp. 105 and 106, says: "The resistance which a moving body meets in air and water, is an effect of the transfer of motion from the solid to the particles of fluid. For the moving body must constantly displace a part of the fluid equal to its own bulk, and the motion thus communicated is so much loss of the motive power. When other circumstances are the same, the denser the medium the greater will be the resistance which it offers. Newton demonstrated that if a spherical body moves in a medium at rest, and whose density is the same as its own, it will lose half of its motion before it has described a space equal to twice its diameter. The resistance encountered by a body moving in water is 800 times greater than if it were moving with the same velocity in air; for water, being 800 times more dense than air, the body must displace and communicate its own motion to 800 times as much matter in the same time." . . . . "The resistance increases as the square of the velocity; for, if the velocity is doubled, the loss of motion must be quadrupled, because there is twice as much fluid to be moved in the rame time, and it has also to be moved twice as fast. Again, let the velocity be trebled, then the body will meet three times as many particles of the fluid in the same time, and communicate three times the velocity; therefore the resistance is $3 \times 3 = 9 = 3^2$."

It would seem from the above that resistance increases as the square of the velocity, and that the power necessary to overcome that resistance increases in the same ratio. This is the opinion of mechanicians generally, we believe. The example given by "Mathematician" would seem to be conclusive; at least his argument is plausible, and if it has not been found true in practice, it must be one of those cases where exact mathematical calculations do not agree with our means of applying natural laws.—EDS.

Liebig on Unfermented Bread—A Correction.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of December 2, there is a recipe, copied from the *Chemical News*, for making unfermented bread. Liebig recommends the ingredients in that recipe because they make more economical and wholesome bread than that made by fermentation with yeast. Instead of using, as is generally done for lightening unfermented bread, a combination of carbonate of soda, with either tartaric acid or cream of tartar, which makes a purgative salt, Liebig recommends the using of muriatic (hydrochloric) acid with carbonate of soda, the combination of which makes common salt, a desirable ingredient in bread. But there must be some error in the proportion of the ingredients given in that recipe, which I am surprised that some of your readers have not corrected ere now. Reducing the French measures in that recipe to English measures, the proportions there given are: 1 pound flour, 70 grains carbonate of soda, 300 grains muriatic acid, 300 grains common salt, ¾ pint of water. The proportions of soda and acid in this recipe are, for the end in view, incorrect, being about 1 to 4; while the proportion to make common salt will be about equal parts of each; much excess of either beyond that which makes common salt being detrimental to the bread. Then, the amount stated of common salt is greatly in excess, because the amount, including that which the acid and soda make, will be nearly one ounce to one pound of flour.

It is remarkable what different opinions celebrated chemists give of this kind of bread. In 1846, a London physician gave the following recipe: 1 pound of flour, 40 grains carbonate of soda, 50 grains or drops of muriatic acid, 1 teaspoonful of powdered sugar, ½ pint of water, or as much as may be necessary. Bake in two loaves. He says that bread thus made is more digestible than biscuit from its lightness and porosity; that it saves time and trouble in the preparation compared with bread fermented with yeast; and that it is not liable to be vitiated by bad yeast or by fermentation. But a writer in the supplement to "Ure's Dictionary of Arts and Science" (Dr. Normanby, I think), says that bread prepared in this way is with difficulty permeated with fluids; that it will not absorb water, hence its heavy and clammy feel; nor saliva, hence its indigestibility; nor milk, nor butter; and that it will not make soup, or toast, or poultice. This may be true if the ingredients used are proportioned as above; but if the proportion used be those given below, I claim for the bread all the good qualities that Liebig claims, and all the qualities that Normanby denies that it possesses. 1 pound flour, 100 grains of carbonate of soda, 60 grains of common salt, 1 teaspoonful of powdered sugar, 120 grains of muriatic acid, more or less, according to its strength; 1 wine pint of water, inferior flour will require less. Intimately mix the flour, soda, salt, and sugar in an earthenware vessel, then add the acid mixed with the water, and stir with a wooden spoon. Bake in one loaf for about one hour. The color of the loaf should be a light brown. The bread may be baked in an iron or tin pan, but, in mixing, the use of metallic vessels or spoons must be avoided. J. C.

New Harmony, Ind.

Expressional Dentistry.

MESSRS. EDITORS:—I was glad to see an article in your valuable paper on the above subject, in respect to which a want has been felt by the profession.

Why are we not proficients in artistic or expressional dentistry? It is because we have had imperfect materials with which to do our work as artists. We have been cramped and hampered by many rude instruments and articles, though so much has been accomplished toward the true and the beautiful.

The materials upon which artificial teeth are commonly mounted are gold and silver plate, and vulcanized rubber; with these bases the dentist is compelled to employ porcelain teeth, with gums attached; and when rubber is used, the teeth are made in blocks of two or three. These are made at the extensive teeth manufactories, and are infinitely better than the old bone walrus tooth, or ivory carved teeth, and they have assisted greatly our reputation abroad, for our tooth carvers and tooth molders, are acknowledged the best in the world; but from the very nature of their molded forms and arrangement, the artistic dentist is hampered and restricted in placing them just where he desires to suit the mouth and face and expression of the unfortunate patient requiring artificial teeth. Dentists have all felt this restraint in special cases, and many have spent months and years, and have burnt the midnight oil till health and strength succumbed, to improve this part of our art. Dr. John Allen's continuous gum work is beautiful, and perhaps accomplishes all that the most fastidious artist can desire in affording opportunity for expressional dentistry, but the labor and skill required, and the high price necessary for this work, deprive the masses, who have often as just an appreciation of artistic dentistry as the rich, from the benefits. Much credit is due Dr. Allen and others for their labors in this direction. The most popular material used by the profession for six or eight years past has been vulcanite. It has been popular on account of its cheapness, and the ease with which it can be manipulated; and yet the result of the use of rubber has been to retard rather than advance the artistic part of dentistry. Art has suffered sorely from this cheap and easily made work, and Nature smiles at our attempts to imitate her work with rubber and porcelain teeth in rows like soldiers in a ten cent lithograph. To be convinced of this, we have only to notice in crowds, on steamboats, on the railroad car, on the streets, everywhere, the many, many sets of glistening, regular artificial teeth worn; and when we can discern the artificial, the thing is proved, for expressional dentistry would so hide the art dame Nature herself would not suspect another's work.

Within the past year another long step has been taken toward our ideal by the invention and introduction of consolidated collodion as a new base for artificial teeth. This has been noticed in your paper before, though not in this light; and is well known as the invention of Dr. J. A. McClelland of our city. With it (Rose Pearl is the name it bears) the advantages of the continuous work can be secured. Single teeth are used, and the dentist who may be an artist can arrange them as irregularly and as naturally—as artistically as he may desire, after a study of the features and expressions of the face. This work is easily made, and cheaply enough to satisfy the patient of moderate means. It is lighter in weight than any other material now used for dental plates, and its strength is so great that plates can be made much thinner than rubber or porcelain. The color, too, are those of the natural gums, or mucus membranes of the mouth—it is susceptible of a variety of shades, according to the taste of the operator. With Rose Pearl we can have artistic dentistry, and the profession will appreciate the severe labors of the inventor as much as the people will an artistic set of teeth for a moderate price. C. M. WRIGHT.

Louisville, Ky.

Steel for Axes.

MESSRS. EDITORS:—An article on page 22, current volume of the SCIENTIFIC AMERICAN, headed, "Low Steel—The Requirements of Ax Manufacturers," is calculated to create the impression that the requisite temper for this purpose has not been, and cannot be, manufactured in the country. The minds of the people who peruse your columns for information and instruction, should be at once disabused of any such an idea, and by your permission I will state a few facts, which your East Douglass correspondent, and others interested, will be glad to hear.

The steel manufacturers of both England and America can, and do make ax steel of both mild and high temper, according to the requirements or demands of their customers, who, it is presumed, know better what they want in this respect than the steel maker, who obeys orders strictly, as his great effort and desire is to please his customer, and thereby retain his trade. Collinsville, East Douglass (the home of your correspondent), and other Eastern ax makers, have, for years past, and up to within a short time, always demanded a high temper steel, claiming that it made a much keener edge than a mild or low temper, and was preferable on this account. At the same time the ax would not stand near the abuse in the chopper's hands, it being more easily broken than if made of a mild temper.

The Western ax manufacturers have for years past invariably used nothing but the mild temper, principally manufactured in this city, and of a quality unsurpassed by any made abroad. A high temper steel, while it is claimed it will give a finer edge in a cutting tool, has so many drawbacks attending its use, that the one redeeming feature—the superior cutting edge, is a very expensive and questionable luxury. It is much easier burnt in the process of welding, and easier broken in practical use, especially in frosty weather; and the writer has always been surprised that Eastern manufacturers of edge tools, and of axes especially, would discard a mild tempered steel that is not easily burnt in the process of welding, is tough and strong, and in every way preferable to the other. The difference in the cutting edge is so very fine that the practical chopper cannot appreciate it; for if he did, the Western ax makers, who produce nearly one half of the axes manufactured in the United States, would have had their attention called to this point before this. So that for the benefit of those engaged in manufacturing edge tools, you will be pleased to learn that both mild and high tempered steel for tools has been manufactured in the city of Pittsburgh for years past, of unexceptional quality, and especially the temper which your correspondent is so anxious to obtain, viz.: a low or mild steel, the requirements of ax makers.

Pittsburgh, Pa. AN AX MAKER.

Bean Sheller Wanted.

MESSRS. EDITORS:—Farmers badly want a machine to thresh beans of all kinds. It should be made like the corn shellers with a balance wheel with pulley attached so as to be used either by hand or power, and should be so contrived as to shell beans of different sizes. Such a machine, to cost not more than thirty to forty dollars, would meet large sales both North and South and be a boon to the farmers beside.

Prospect Hill Farm, Va. C. R. M.

A Valued Testimonial.

MESSRS. MUNN & CO.:—Enclosed please find the "wherewith" to renew my subscription to the SCIENTIFIC AMERICAN. My old friends, I would willingly send you subscribers could I do so; but the illness of almost four years, confining me to my house, renders me unable to do so; yet I can send out your circular. Your books will show I have been a subscriber ever since the SCIENTIFIC had a being. My age and illness admonishes me that my name must disappear from your books ere long forever—but I trust for a world without affliction, pain, or sorrow, and where there is no parting.

But, be life longer or shorter, I must have the paper to the end, and shall leave for it my best wishes; and I say most sincerely that I consider it the most valuable paper printed, of any kind. I have only one child, a son, who, if he survives, will be a subscriber in my place.

Please tell your subscribers if you think proper, to follow my example: "Always be subscribers to the SCIENTIFIC AMERICAN; and when a paper comes, stitch it with a fine thread, cut it open, leaving it in book form, convenient for reading, which do carefully and thoroughly; keep it clean; and at the close of the volume, if not ready to get the numbers bound, put them together in proper form for binding, put a board or 'straight edge' on each side, near the back, and then press strongly in a vice; punch holes through them and tie up tightly with a strong cord, and thus have a book."

Schenevus, N. Y. A. HOTCHKIN.

WATER POWER OF THE CONNECTICUT—THE HOLYOKE DAM.

About ten years ago, Mr. Alfred Smith, a citizen of Hartford, Conn., purchased about eleven hundred acres of land on the site of the present flourishing manufacturing town of Holyoke, Mass., now containing over 1,100 permanent residents. It has now in operation fourteen paper mills, two large thread mills, four cotton mills, and other manufacturing concerns. One of the paper mills, that of the Holyoke Paper Company, makes six tuns of paper per day.

The dam, which here controls the whole power of the Connecticut, is one of the most remarkable instances of engineering skill in the country. The Hartford *Times* says: "The only question of the assured and certain success of the company, and the growth of Holyoke to a great manufacturing center, being merely one of the durability of the great dam, Mr. Bartholomew and the company have wisely gone to work to make the dam absolutely indestructible. The work of improvement here is one of far greater magnitude than we had supposed; and its impressiveness as a triumph of engineering skill and a proof of what men's labor can effect over the rude forces of nature can be properly appreciated only by being seen.

"In the flood of last spring the front timbers of the dam were slightly loosened by the concussion of a huge and heavy bridge, which came crashing down on the flood from some point a hundred miles above. An examination of the front foundations, while it disclosed no very serious injury to the great dam, revealed another fact of some interest. The river bed at this place is for a considerable distance composed of rock—but a rock full of seams; and the steady, continuous fall of the great sheet had by hydrostatic pressure lifted out the rock in masses, and scattered boulders of a tun to twenty tuns weight for a considerable distance down stream—making, at last, a great hole in front of the dam, from twenty-six to thirty feet deep! or as deep as the deepest places in New London harbor.

"It was found necessary to check this destructive work; and accordingly the dam, which has for so many years presented a sheer fall from its edge, will now be made with a sloping front as well as rear; so that it would, if the river were dry, present an outline similar to that of the peaked roof of a house. This front extension is fifty feet in diameter at the base, presenting a uniform slope to the top, that will so graduate the fall, for its entire width of over a thousand feet, as to make it look more like a great rapid than the old familiar Holyoke dam.

"This work is done by sections; the first, which was begun in September and is now nearly finished, being 269 feet wide in the middle of the dam.

"It is made of solid timbers, fastened in layers crosswise, in the way known to builders as "crib-work," and filled in with an enormous ballasting of stone. These solid masses of timber, bolted and riveted together for such an extent and hight, present, to one unaccustomed to it, a very impressive sight. Unlike the old dam, the new front will be solid; no openwork timbers. The timber "cribs" are sunk, and the rock ballast filled solidly in beneath them in the higher part, with a good deal of engineering skill. The engineer is Mr. S. S. Chase, whose uncle, we believe, built the original dam. He floats down a good deal of his timber from Vermont. It consists largely of hemlock, a timber which resists decay and the action of water beyond most others. Chopping into the wood of the old dam, shows that twenty years have failed to damage it a particle; it is as sound as ever.

"They have put down in this section about one million feet of timber. That fact tells the story of the literal solidity of the new dam.

"It is found that the weight or force of the stream, exerted against the dam at all times, is nearly four thousand tuns. The weight of this new structure above the water is 13,000 tuns.

"Looking at it from the shore, this section of 269 feet seems but a little part of the whole breadth of the fall; but to a person standing on it, at its lower or its upper edge, it seems in itself a "big thing."

"The construction of the fish-way, for salmon and shad, had to be delayed on account of this improvement on the dam. It will be made, at the east end of the dam, as soon as the latter is finished.

"One of the rocks lifted out from its natural bed by the hydrostatic pressure in front of the old dam, weighed, before Mr. Chase blasted it, twelve tuns; and yet it had been taken out and moved a hundred feet down stream by water power."

There are between twenty and thirty mills and factories in active and profitable operation at Holyoke, all the power required being taken from the great dam. It is distributed at present by three canals at different levels, and affords an immense power. The water power of the Connecticut at Holyoke is estimated by competent engineers as equal to that of Lowell, Mass., and Manchester, N. H., combined. It subjects to the service of man the whole volume of the Connecticut river, which here pours over a steady flood, reliable at all seasons, of 1,017 feet in breadth, at a fall of between 25 and 30 feet, but less than one-fifth of the power is yet utilized.

Successful Trial of the Shelbourne Submarine Drill.

Considering that it is an entirely new invention, and has never yet been thoroughly tested, Mr. Shelbourne's experience with his machine for drilling sunken rocks during the last three days in the swift currents of Hell Gate must be considered as eminently encouraging. As was intimated in our previous article, the pipe used to convey the exhaust steam from the engine inclosed and sunk with the "mushroom" was found too flexible and too small. A larger and firmer one had to be procured from Boston, causing a delay which prevented any trials of the drill from being made on Tuesday. Yesterday the new pipe was severely tested in a very swift current, and found to work satisfactorily. Assuming the machinery of the drill to be in working order, the first problem is to keep the floating derrick stationary while the holes are being bored. The *Wallace*, the boat which has been chartered by Mr. Shelbourne, is about sixty feet long, and quite shallow, yet on Monday it was found impossible to hold her with several large granite boulders, weighing four tuns each. These were intended for use only as temporary moorings, while four holes six feet deep, should be made by the drill for the insertion of ring bolts. To these, which are marked out like the bases on a base-ball ground with reference to the pitcher, cables will be extended from the *Wallace*, which will then be firmly fixed as though tied to a wharf. Yesterday the first hole was drilled and the first ring-bolt inserted. While the tide was still running strongly, and contrary to the advice of her experienced commodore, the *Wallace* steamed out over the Frying Pan and dropped one of her boulders overboard. At first the current slowly carried the vessel along, the huge stone dragging on the bottom, but at length the anchor caught in the rocks below, and the *Wallace* was brought to. So far so good; but work must be done before the turning of the tide. The ponderous "mushroom" is swung out over the boiling waters, while the diver incases himself in his horrid habiliments. Both speedily find their way to the bottom. The diver sees that the drill is in proper position, and everything being reported right, at last Mr. Shelbourne gives the word to turn on the steam. It works to perfection. Standing by the anaconda-like steam pipe, you can hear distinctly the machinery in operation below. An hour passes, and the tinkling of a little bell gives the longed-for information that a hole six feet deep has been sunk in the Frying Pan Rock. The ringing of this little bell is one of the most beautiful ideas embodied in the invention. It is done by electricity, and is, in fact, the Atlantic Cable on a small scale. Mr. Shelbourne pulls a cord, which reverses the motion of the machinery, and presently another tinkle of the bell informs him that the drill is withdrawn from the rock, and that the "mushroom" is ready too root itself in another spot. And now the diver, with a ring-bolt six feet long, a sledge-hammer, and other implements, descends again, and in an amazing short space of time is drawn up to announce that "he has stuck a pin." There not being time to shift the position of the *Wallace*, anchor again, drill another hole, and get off this tide, the "mushroom" is hoisted on board, and we start back for Jersey City. To-day another and perhaps two ring-bolts will be put in. When all are down, and the *Wallace* permanently moored, Mr. Shelbourne will be ready to work night and day, and soon Hell Gate will be shaken by the discharge of nitro-glycerin, and the diabolical Frying Pan and Pot be shattered.—*New York Tribune of Jan. 14th.*

Clock making in Bristol, Conn.—Ingenious Inventions.

Bristol, Conn., is noted for the manufacture of clocks. The business is divided and subdivided into several distinct branches, so that there are only five firms in the town that manufacture complete clocks, while twenty firms are engaged in making the different parts of the same. The New Britain *Record* gives the names of these firms as follows:

"The Bristol Brass and Clock Company, where the brass is rolled into plates; the brass founderies of Lester Goodenough, where ratchets and sockets are cast; the works of the Bristol Foundery Company, where the weights and alarm bells are cast; the works of L. F. and W. W. Carter, where movements and cases are put together and the finished clock with Lewis' patent calendar attachment is produced. Clock springs and springs for toy movements are made by E. B. Dunbar and Wallace Barnes. S. E. Root makes sash and paper dials patented by himself. W. H. Nettleton makes lock works and pillars, and straightens and cuts wire. A. Warner and Mr. Taylor make verges, pendulum rods, and wire bells. N. Pomeroy, L. Hubbell, and S. E. Root manufacture movements. E. N. Welch Manufacturing Company, Atkins Clock Company, E. Ingraham & Co., and Mr. Partridge are large manufacturers of both movements and cases. Geo. W. Brown & Co. have also a large factory for the manufacture of clockwork toys.

"The clocks are produced in great variety, and range in price from one to eighty dollars each. Some are so constructed that by one winding they will run respectively, thirty hours, eight days, thirty days, and one year. A self-winding attachment is also made at Bristol, which is placed in the draft of the chimney, and the clock no sooner runs down than the draft, operating a fan, winds it up again. This little invention is a source of great income to its author. A perpetual calendar attachment, which will correctly indicate the day of the week and month, is also made, the patentee of which receives as royalty for the right to manufacture an income of $3,000 per year. An important improvement on the original invention has recently been made and secured by letters patent.

"Most of the workmen employed in clockmaking are 'specialists' who have labored many years at some particular part, and though they have become experts at their business, their wages are lower than those of most other mechanics, ranging from $1·75 to $2·25 per day. Much of the work is 'put out' to be done by women and girls.

"At present the clockmakers are busy making movements for a walking doll, a New York firm employing five hundred girls in making the dolls to which they are to be attached. Many other mechanical movements for various purposes are also made, among which are movements for lamplighters and fans, cradle rockers and baby swings (in which the baby is the pendulum ball), coffee roasters, works to ignite torpedoes, and works for a variety of animated toys. The first clockwork toy ever made was a toy engine, invented at Bristol, but the inventor never took out a patent, and probably escaped the miseries of a large fortune."

An Opportunity for Enterprise.

Not seldom we are addressed by inventors soliciting aid in the disposition of the improvements they have perfected, their object, generally, being to dispose of the whole or a portion of their patent right in return for present pecuniary assistance. As we invariably decline doing a commission business of this character, we can take no action upon such appeals, unless occasionally to draw attention to the matter by a notice in our columns.

A case now before us, however, we cordially commend to the attention of those who are seeking a desirable investment for a moderate sum. It is an improved weighing scale, the subject of a patent just obtained by S. S. Hamilton, who may be addressed at Taylor's Falls, Chisago Co., Minn. Very favorable terms for the patent may be obtained by addressing the inventor as above, as he is in ill health, which precludes him from personal attention to the necessary business of manufacture and introduction. We think the opportunity is a good one to obtain an interest in a valuable invention, and at the same time assist a very worthy invalid to go to a warmer climate, which his health demands.

FUSEL oil, tannin, acetate of lead, oil of vitriol, strychnine, creasote, Prussian blue, mountain dew. The *World* has done the community good service in exposing the villainous compounds which are daily sold to our citizens under the name of rum, gin, brandy, and whisky. What will the *World* say to the enactment by the Legislature of a law prohibiting the sale of such poisonous compositions, unless prescribed by a competent physician? The inquiry strikes us as a pertinent one, in view of the exposure which has just been made. We hope that our able cotemporary will give the public the benefit of its views upon this question.

Improvement in Railway Car and Locomotive Wheels.

Much of the necessary expense of working railway lines is to be charged to the deterioration of the rolling stock, subjected, as it is, to the constant percussion of one rigid body, the wheel, on another unyielding surface, the rail. The slightest degree of elasticity in either would partially remedy this evil, and reduce the cost of repairs to track and rolling stock; but if this elasticity is confined wholly to the track, the power necessary to propel a train is enhanced, although the attention of railway managers, both in this country and Europe, has been for several years directed to methods intended to secure a permanent way. The elasticity sought, on the other hand, for the rolling stock, is wholly confined to springs interposed between the axle and the body or weight of the carriage or engine. It is well known, however, that this does not relieve the excessive wear and rapid deterioration of the rolling or running parts—the wheels and axles—which are subjected to perpetual hammerings. The objects of the improvement, illustrated in the accompanying engravings, are to provide a wheel which while always presenting a rigid face to the surface of the rail shall pass without jar over inequalities in the road, preventing concussions on the axle, relieving the shock of lateral motion, and the jar on the carriage, and furnishing a wheel immensely stronger and longer lived than any rigid wheel now in use. These objects attained, not only are the life and efficiency of railway rolling stock extended and increased and the expense of running trains consequently reduced, but the comfort of passengers and the safety of freight greatly enhanced.

Fig. 1

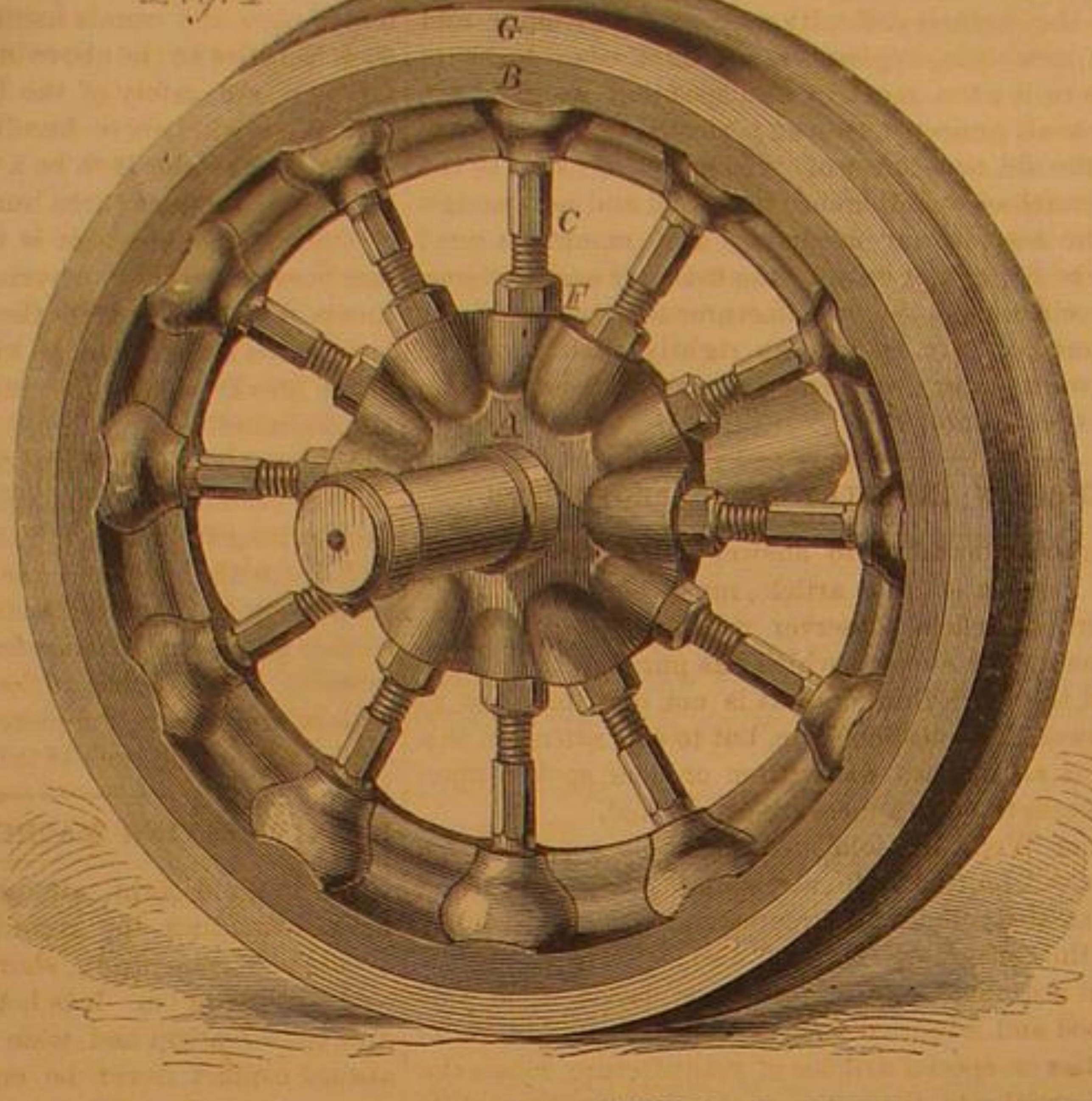
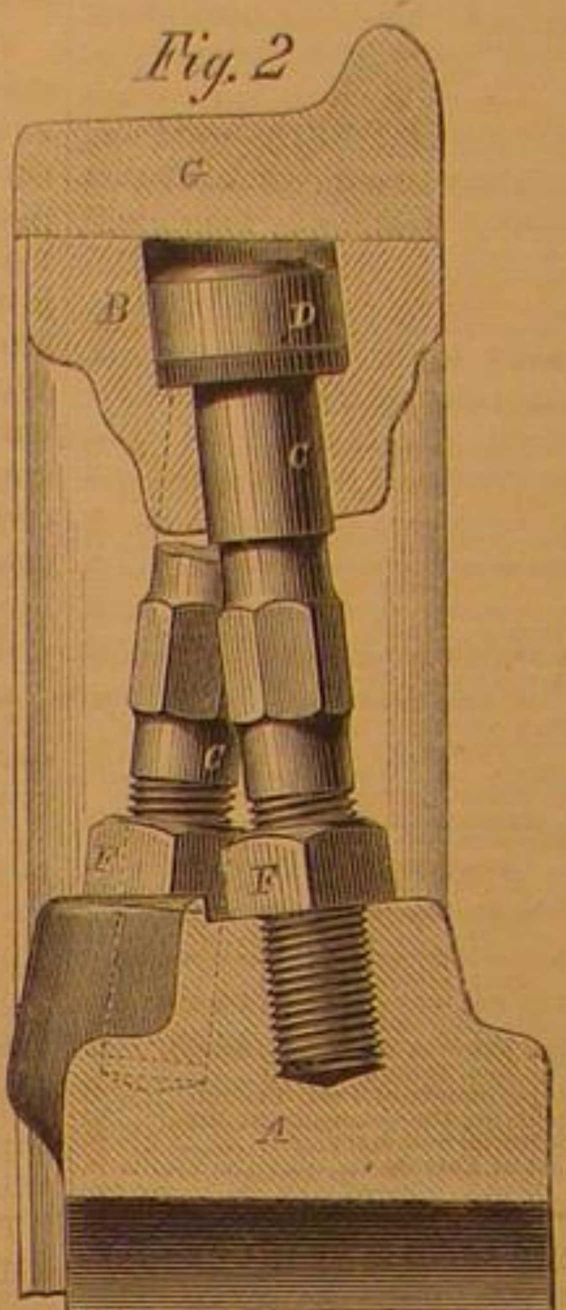


Fig. 2



AYER'S PATENT CAR WHEEL.

Fig. 1 is a perspective view of Ayer's Car Wheel, and Fig. 2 a vertical section from the axle to the tread. The hub, A, and rim, B, are of cast iron, the best stock being used. These are united by wrought iron spokes, C, each alternate spoke leaning at an angle from opposite sides of the central circumference of the hub to the central line of the rim. This is to receive and relieve the lateral shock in running caused by inequalities in the rails or the rounding of curves. The hub is tapped to receive each spoke, which is screwed into it, passing through holes in the rim. Each spoke has a head, D, seated in a recess, and between the under side of the head and the bottom of the recess is interposed a cushion, E, of rubber, between which and the head is a washer of iron or steel. The wheel is trued and the pressure on the elastic cushion adjusted by the nut, F, bearing on the hub; a portion of the spoke being squared, as seen, for the reception of a wrench. The spokes are passed through the rim, screwed into the hub, and the wheel is finished by a tire, G, made of Krupp's best steel, rolled without a weld from a solid ingot.

The weight acting on the hub is suspended from the rim by the wrought iron arms, or spokes, and rests at all times on an elastic cushion. A wheel made on this plan has been found by long trial, under the most exacting circumstances, to wear perfectly round, to withstand uninjured the severest shocks, and to wonderfully increase the comfort of passengers, in the reduction of noise, the absence of jar and jolt, and the additional security from accident afforded.

It is the subject of two patents by Charles C. Ayer, of Lynn, Mass., assignor to himself and Henry A. Breed, of the same place. Manufactured by the New York Steam Engine Company at their works, Worcester, Mass. All orders should be addressed to the Ayer Patent Wheel Company, 126 and 128 Chambers St., New York, where specimens may be examined

Transmitting Steam Power.

At the shops of the Portland and Kennebec Railway a large steam boiler has been put in the wood shop of the company, and from this boiler a three-inch iron pipe leads under ground to the machine shop, a distance of four hundred and fifty feet, conveying steam power for driving two engines of twenty-five and fifteen horse-power, carrying all the lathes and other machinery of an extensive establishment. The pipe is four feet under ground, is inclosed in three-quarter inch hair felting, and encased in a seven-inch box filled with calcine plaster. It has three slip joints to prevent breakage by expansion. When there is a pressure of 80 pounds of steam at the boiler, the same pressure is maintained at the other end of the pipe. The new arrangement is found to work admirably, and will be a great saving in machinery, labor and fuel.—*American Railway Times.*

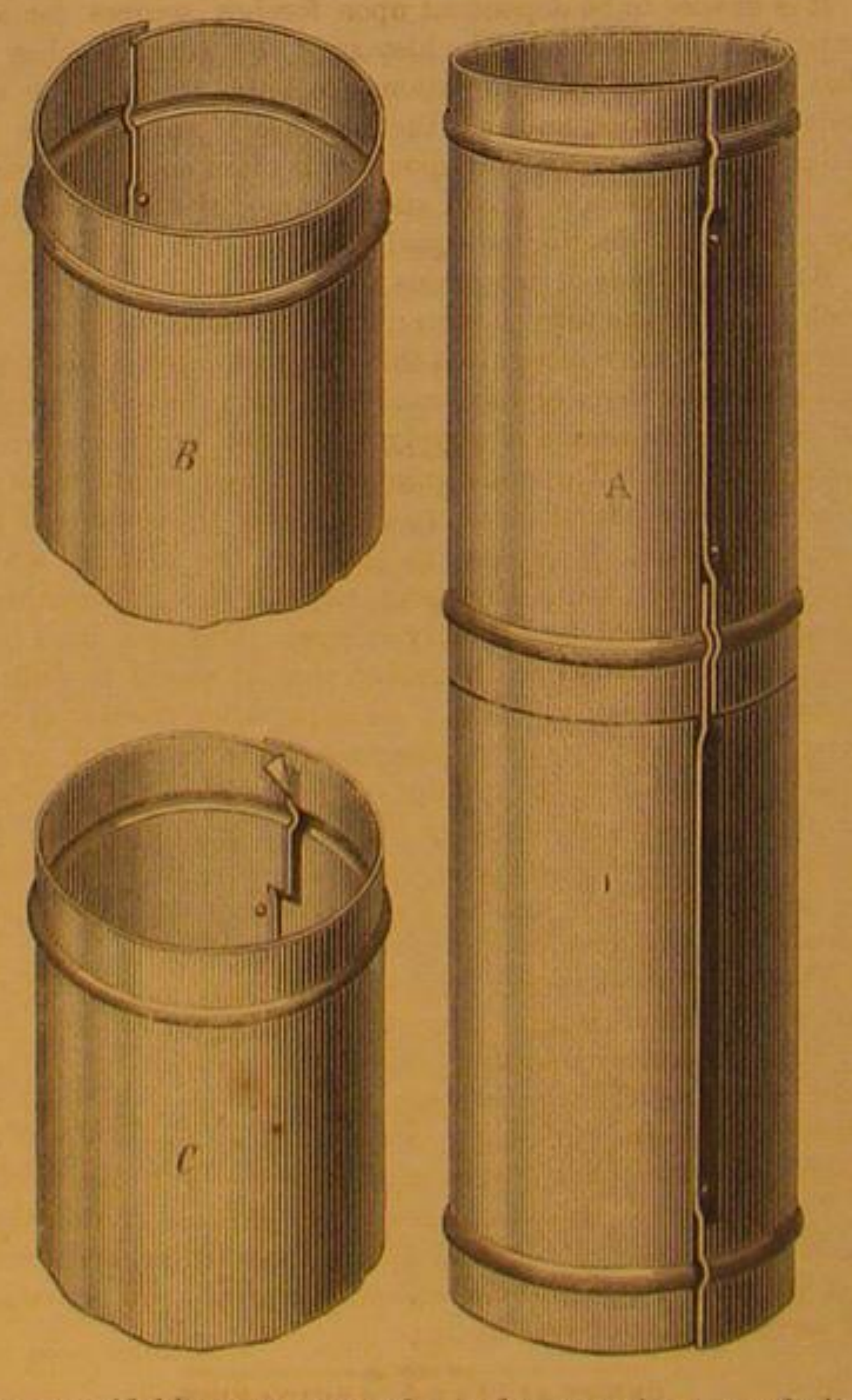
Cheap and Good Smoke-House.

A Western New York farmer publishes his plan of a small, cheap, and good smoke-house, which, as it may contain some practical hints for our readers, we append:

"No farmer should be without a good smoke-house, and such a one as will be fire-proof and tolerably secure from theives. Fifty hams can be smoked at one time in a smoke-house seven by eight feet square. Mine is six by seven, and is large enough for most farmers. I first dug all the ground out below where the frost would reach, and filled it up to the surface with small stones. On this I laid my brick floor, in lime-mortar. The walls are brick, eight inches thick, and seven feet high, with a door on one side two feet wide. The door should be made of wood and lined with sheet-iron. For the top I put on joists, two by four, set up edgewise, and eight and a half inches from center to center, covered with brick, and put on a heavy coat of mortar. I built a small chimney on the top in the center, arching it over and covering it with a single roof in the usual way. An arch should be built on the outside with a small iron door to shut it up, similar to a stove door, with a hole from the arch through the wall of the smoke-house, and an iron grate over it. The arch is much more convenient and better to put the fire in, than to build a fire inside the smoke house, and the chimney causes a draft through into the smoke-house. Good corn-cobs or hickory wood are the best materials to make a smoke for hams. The cost of such a smoke-house as I describe, is about $20."

FAINT'S PATENT STOVEPIPE JOINT.

Most of our readers know something of the annoyance of putting up stovepipes, the difficulty of entering the joints, the liability of their separation while the work is being done, and the unavoidable smut, arm ache, and temptation to profanity. The plan shown in the accompanying engravings makes the joining of stovepipes as "easy as rolling off a log." By this method the pipes can be joined when the connecting ends are of the same size; the sections are securely fastened and cannot fall apart, and the operation either of joining or taking apart is performed instantly; the joint, when made, is as closely fitting as where one end slides into another; when rusted they may be separated as readily as when clean, and when put together the joint has as neat an appearance as those made in the ordinary way.



A, in the engravings, represents the two sections of the pipe joined. B is one section showing the unconnected or unriveted portion of the seam between the bead and the end, and C is a similar section also open at the seam and having the corner of the inner edge bent to form a stop for the inner edge of B. The difference between a true circle and the opening of the lap at the seam is only sufficient to admit easily the passage of the sheet iron.

In use the two ends are brought together, one edge entered into the opening between the lap of the other, and turned about one-third of a revolution, with a slight endwise pressure, when the parts are securely locked by this simple rotary or spiral motion. With this method there is no necessity for suspending the pipe, unless of very great length between the points of support, as the joints are so stiff that no appreciable sagging takes place.

Patented Dec. 8, 1868 by John Faint. For further information address or call upon John and G. B. Faint, Tremont House, 665 Broadway, New York

A New Alloy for Coin.

The authorities of the mint in France have been experimenting upon zinc for replacing copper, either partially or entirely as an alloy for the silver coinage of the country, and articles of silverware generally. The advantages are said to be that the metal is more homogeneous, has at least as fine a white luster, and possesses a clear ring and considerable elasticity. When toughened by continued or repeated rolling, it is restored by simple heating, and is less liable to be blackened by exposure to the sulphureted hydrogen of the atmosphere, while there is no green coating formed with acid liquids. A mixture of 835 parts of silver, 93 of copper, and 72 of zinc is recommended.

OBITUARY---DEATH OF A NATURALIST.

John Cassin, a distinguished naturalist, died in Philadelphia on Sunday morning last, the 10th inst. Mr. Cassin was born near Philadelphia, September 6, 1813. In 1834 he became a resident of that city, and was, for a few years, engaged in mercantile pursuits. From early youth, however, his favorite study was ornithology, and in his later years occupied his whole attention. He contributed description of new species of birds and synoptical reviews of various families to the Philadelphia Academy of Natural Science. His more elaborate publications are "Birds of California and Texas," a handsome octavo volume, containing descriptions and colored engravings of fifty species not given by Audubon; a "Synopsis of the Birds of North America;" "Ornithology of the United States Exploring Expedition;" "Ornithology of the Japan Expedition;" "Ornithology of Gillis' Astronomical Expedition to Chili;" and the chapters on rapacious and wading birds in the "Ornithology of the Pacific Railroad Explorations and Surveys." His works are the result of careful research, and are especially valuable for their descriptions and classification of many birds not given in the previous works of Wilson and Audubon. Mr. Cassin was of a Quaker family, several members of which have distinguished themselves in naval and military service.

A Novel Method of Catching Mice.

A correspondent of the "Journal of Pharmacy" says: "Having on several occasions noticed mice in our seed barrels, I bethought me of some method how I might trap the little intruders; they having gained entrance by eating through the chime. To kill them with a stick was impracticable, as the little fellows would invariably escape as soon as the lid was raised to any hight. I then thought of saturating a piece of cotton with chloroform and throwing it in, then closing the lid. On raising it again in a few minutes, I would find that life had almost or quite departed. Having on one occasion left the piece of cotton in the barrel, on again returning, found three mice with their heads in close contact with it, and dead. In the evening I saturated another piece, and placed it in the barrel, and on opening it the next morning, to my surprise I found *nine dead mice.*" We recommend our Chicago friends to try chloroform on their rats, and see what effect it will have.

Rice is a valuable crop in Louisiana, a rich planter in St. James Parish, determined to sow rice for the use of his family and his farm hands on about one hundred acres, which he had to spare after planting his sugar cane. His rice crop filled 1,400 barrels, the greater number of which he disposed of on the plantation at $21 a barrel; the entire cost of plowing, sowing, and preparing the grain for market was $4,000. If he had sold all the barrels, which he could easily have done, at $21, his clear profit would have been $25,400.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

OBSTACLES IN THE WAY OF THE SUCCESS OF INVENTORS.

The difficulties which want of means and influence places in the way of inventors, the compulsory exactions of poverty and the discouragements of those who should stand ready to aid with their influence any attempt to relieve the *onus* of labor and increase the return of capital employed, seem to be enough to dishearten those who hope by their improvements to benefit themselves while adding greatly to the advantage of their fellows. But these difficulties overcome, there are others still greater in the path to pecuniary success, which must be removed before the benefit intended can be realized by the mass. We allude more particularly to the jealousy with which any improvement, deserving the name, is viewed by those whom it will most directly and certainly benefit.

Possessors of capital, whether it is invested in mechanical enterprises or not, view with more than a critical eye any device which proposes to aid them in the increase of their capital or its advantageous investment. To them the inventor appears as a harmless visionary, annoying and verbose, impractical and troublesome, well got rid of by a few words of milk-and-water encouragement, or perhaps by a bluff notice that their time is too valuable to waste on him. In consequence of these rebuffs, perhaps often repeated, the disappointed and disheartened inventor ceases effort, sees afterward his invention reproduced by another, made one of the grand inventions of the age, and spends the remainder of his life in legal squabbles, out of which he will consider himself fortunate to secure the crumbs of the feast at which the capitalist and the plagiarist fare sumptuously.

Singularly enough it is that those whose experience has driven them through a similar course, and who by a lucky stroke have achieved pecuniary independence are among the last to recognize the value of an invention or the claims of the inventor. And those whose fame, if not fortune, has been attained by their persistence seem ashamed to make their virtue of perseverance glorious by encouraging followers in the same path. It is almost as difficult for an inventor to procure even an interview with the men whose inventions and discoveries have made their names famous as to achieve a presentation to Queen Victoria or the Emperor Louis Napoleon. But these notable men are not ignorant or forgetful of the means that gave them fame; for at dinners given in their honor and in sketches or biographies of their lives they are not ashamed to rehearse the circumstances of annoyance, the obstacles, the difficulties that faced them and troubled them before success was assured. But they seem to suppose that their inventions and their value to the world absolve them from any further concern about the welfare of the race or the well-doing of individuals. The old British doctrine, "Once a subject always a subject," is entirely applicable to the realm of invention. No man who has worried through the annoyance, and trouble, and travail, and agony of discovery, and come out successful against great odds, has any right to repudiate his allegiance to the great republic of improvers and refuse his aid to those who strive to reach his eminence.

But these are not the worst obstacles in the way of the inventor. His patent secured, the favorable opinion of experts and influential persons obtained, and even a fair trial having proved the superiority of his device over others used for a similar purpose, he must meet the unreasonable objections of unreasoning or captious men. He may have considered his path easy after having demonstrated by fair experiment the absolute valve of his invention, but the road is still rough.

Introducing his device and procuring the assent of the party to whom he wishes to dispose of a machine, or right, he is not certain that he has made a success, even in a single instance. Although no direct objection can be urged against the facts adduced or the demonstration shown by experiment, not unfrequently the purchaser and user will bring forward some objection not really tenable, and without logical argument to support it, but which, to him, is all-sufficient. It is difficult to manage such cases. It is hard to combat prejudice. Attachment to old forms of tools, to machinery perfectly understood, to familiar methods, is hard to overcome. With all their faults the mechanic loves his own tools and own methods the best. Only the all-powerful influence of interest can avail to overcome this sentiment.

This conservatism—vulgarly called old-fogyism—among mechanics, is the hardest difficulty met by the inventor and introducer of new tools, appliances, and methods. Is there not too much of it; too much of a disposition to give the cold shoulder to all projected, or even perfected improvements; too much of the old time sneer of "visionary" directed to the inventor, too much of an adherence to the old and not enough attention to the new, by our mechanics and manufacturers? Would it not be better, not only for the inventor or discoverer, but for the mechanic and the manufacturer to look fairly, try impartially, test honestly, and judge rightly, than to allow prejudice to work injury to themselves and produce disappointment to the inventor?

DOES AMERICAN INDUSTRY NEED PROTECTION?

The man who undertakes to answer the question which stands as the caption of this article, must be one of broad views. A mere superficial observer must necessarily err in his conclusions upon a subject, which has puzzled the minds of careful and thorough thinkers. It is not our intention to definitely answer this question here, but to call attention to a point, which, in all that we see written or hear spoken upon the subject, seems to be in a measure overlooked.

Commissioner Wells has told us in his able report, that a tariff is a tax.—Admitted. He also asserts that a tariff on imports is a tax that, under all circumstances, is paid wholly or in part by the consumer. Granted also

The general argument against protection based upon this well understood and admitted fact, is that the imposition of protective duties on special articles of manufacture raises the price of these articles to the entire mass of consumers, while a few are enriched by their production. The general answer to this argument which is as old as the idea of protection itself, is, that the advantages which accrue to the commonwealth from the protection of special industries, by the wise imposition of duties, compensate for the increased price of the taxed products. We believe this position is sound, but without rehearsing the arguments usually put forth in its support, we will at once state our proposition. The political health of any commonwealth demands a diversity of industries. The cheap lands and the high rates of labor prevalent in the United States, as compared with Europe, naturally tend to unduly develop agriculture, at the expense of many industries of vital importance to the general good. These latter, fostered by a judicious legislation, can be sustained without detriment to the agricultural interest.

It is unwise to be dependent upon foreign sources for any important production. The history of the world teaches us that the relations between nations are liable to frequent and serious disturbance, and that the increase of values upon articles of import consequent upon war is often enough to make the domestic manufacture of such commodities remunerative for a decade, if distributed equally during such a period.

But especially is it dangerous to fail in the protection of such industries as furnish material for national defence. All governments have recognized this fact, and have either taken full control of them or have made it certain that the cutting off of a foreign source of supply would not prove a source of embarrassment. The same principle can and ought to be applied to such productions as are essential to the comfort of the people at large. It is easy to imagine the distress which would be felt in some European states if the importation of breadstuffs' should be suddenly stopped. Our own land is so wide and its products so diversified that it would be difficult to name a commodity which, if its importation should at once cease, would now seriously embarrass the Government, or materially detract from the comfort of the people; but it is easy, we think, to see how improper legislation might so dwarf the home production of—say iron for example, and to stimulate its importation, as to render such a contingency as we have named not only possible but probable.

There is another reason why national prosperity is dependent, among other things upon diversified occupations. It is by this means only that the full mental power of the population can be developed. All are not adapted to pursue the same calling, and different pursuits are as necessary to the health of a nation as different articles of diet to bodily health.

The danger of enriching a few at the expense of the many, is, in this country, limited by a free competition; and we are not in sympathy with those who view a proper protective tariff as the parent of monopolies.

CENTRAL LAKE NAVIGATION.

The grand chain of lakes occupying the center of the North American Continent together affords navigation almost oceanic in its proportions. The improvement and development of these great waters have, with the increased settlement of the fruitful regions surrounding them, become a matter of necessity, and the public will be interested to know something of what is now being done in this direction.

General T. J. Cram, of the United States Corps of Engineers, is now directing the improvement of what is known as St. Clair Flats. The improvement consists in the construction of a canal, one and one-half miles in length and three hundred feet wide, and of sufficient depth to permit the passage of vessels drawing thirteen feet at low water, and is built with a view of increasing its depth to eighteen feet in future if required. The bank is flanked by dykes of timber to be filled by the excavated earth. The timbers are to be saturated with creasote to retard decay. Few unacquainted with the subject will realize the great increase of facilities for navigation which this canal will afford. An examination of a map of the lakes will however show at once the importance of the work.

At Chicago, other improvements worthy of notice are progressing under the direction of the Chicago Dock and Canal Improvement Company. These improvements consist of a system of piers and canals having for their object the increase of dock facilities at the above named city and a huge breakwater for increased safety of the harbor. The canals are to extend into the town, twelve hundred feet from the shore line.

The breakwater is to be a very extensive structure. It is to be built in sections three hundred feet in length, to be sunk to to the water line; and it is contemplated to build thereon an immense storehouse covering the entire length, if experiments shall demonstrate the safety of such a structure. The entire area the storehouse will cover, from which also the size of the breakwater can be estimated, is one hundred and fifty-six thousand feet.

The canals are to be divided by cribwork consisting of two rows of piles driven as closely together as they can be set, and capped longitudinally with timbers. The space between is to be filled with stone, and planked. The docks are to connect with every railroad in the city by special tracks and switches, so that goods can be transferred directly from the cars to the vessels. The expense of the work is estimated at two million dollars, and when completed will be as complete and convenient as any system of inland dockage in the world.

IS LABOR-SAVING MACHINERY THE ENEMY OF LABOR?

The old, old fight, almost interminable, and persisted in notwithstanding the recorded verdict of history—and the events now transpiring, shortly to become a portion of history—is still going on. It is between ignorance and enterprise, dull conservatism and wide awake improvement. Will this absurd conflict never be ended? Will our would-be social theorists ever be willing to accept facts as better than their theories? Will ever the Malthus philosophy cease to affect social relations and the opinions of those philosophers whose thoughts intend to "shake mankind" and mold the ideas of the active ones who strive to make these thoughts a reality? Is the advance of the race by means of new scientific discoveries and new mechanical improvements to be checked by the bugbear of a plus of laborers over the work to be done? Have we reached the point where we must either stay the progress of labor-saving, and time-saving, and brain-saving, to allow the muscle as wielded by the puny arm of man to exploiter us and prevent all progress by brain muscle, or allow the serfdom and feudal lordliness of the past ages to return? Must all our boasted improvements in the arts and the sciences be considered only as toys for the intellect, unaffecting the well-being of the race? Shall we return to the laws of Lycurgus, and immolate our progeny upon the altar of national advantage, as understood by the fearful disciples of Malthus?

Such would seem to be the idea of some theorists. A gentleman of culture—æsthetic and literary—called upon us a few days ago to make inquiries relative to the subject of supply and demand as concerning the progress of the race. He seemed to be devoted to the idea that the supply of labor exceeded the demand, and that labor-saving contrivances were only laborer-slaying devices. The information we might give him in relation to this subject as shown by the record of patents, and their aggregate or proportionate usefulness, he supposed might be available to sustain what was his plainly preconceived view, that the laborers were many and the harvest small. He alluded to the destruction of labor (life) in our late war as something like a "providential dispensation," to weed out and lessen the choking growth of laborers in our social garden. We could not give him encouragement.

That some of the centers of manufacture and commerce are overcrowded proves nothing in favor of the idea that the laborers are too many. It proves only that this labor is misdirected, either by its possessors or others. Commerce, or rather the mercantile branch of business has grown to be a fungus on our industries. It was once used and is now calculated to be a support and aid to productive industry, but that it has proved to be either a parasite or a fungus, garroting the growth and sapping the life of industry, alluring by its temporary or periodical luxuriance, does not prove that labor is less in demand, only that other means of living than that of direct labor make seemingly fairer offers. If the cities are crowded, the country is open; if it is hard to procure even indifferent shelter and precarious living in crowded cities, both are easily obtained outside. Take the State of New York, for instance, and go through the nearest one hundred miles from the metropolis, what acres upon acres, miles upon miles of fertile soil which one passes on the line of a railroad, may be seen from the window of the swiftly gliding car, that seemingly have never felt the magnetic and magical touch of the laborer's hand! This State alone has unoccupied and unused land enough to give good homes and profitable or comfortable incomes to all the possessors of muscle and brain, however uneducated, that come to our shores from foreign lands in a twelvemonth.

Do the improvements made by researches in science or experiments in art add to the difficulties of labor in seeking its reward? We cannot see it. On the contrary, every advance, even if it includes the production of labor-saving devices, opens and clears the way for the pioneer, the laborer, the *avant guard* of civilization. Has the sewing machine been a benefit to the women who before lived by sewing? Let the demands for female seamstresses daily published in our journals answer. Has the introduction of railway trains driven by steam diminished the production or the price of horses? Let the plain facts of to-day reply. Has the adaptation of steam to river and ocean navigation diminished the amount of freight and the number of passengers conveyed, or even the number of men heretofore employed? The condition of this business as compared with itself fifty years ago is a sufficient demonstration of the value of labor-saving machinery in this department.

The proudest days of the Roman empire saw a state the wealthiest members of which knew less of the luxuries of life than the ordinary American mechanic of to-day, and the workers were simply slaves whose liberties and lives were held in fee simple by their masters. While their masters shivered in the cold of their unheated marble palaces and gorged themselves on food, barbarously cooked, their slaves courted any sunshiny corner for warmth and greedily devoured the leavings we now think fit only for dogs. Then, the only relief from this state of vassalage was the army. Here, even, the soldier was not always sure of his regular food, but like the savage dogs in Eastern cities in our own time, or the wild beasts of the wilderness, he must fight for, or thieve for, or murder for it, before he could get it. Even the commonalty (*Cives Romani*) were only hired hinds, the tools of warlike generals, the victims of licentious civilians, or the protegés of a wolfish government, that raised her cubs to imitate the fabulous dam of the empire's founder. There were laborers enough then, but their labor was enforced and their pay stripes, imprisonment, or death. They had brains as we, but they did not invent; they had necessities but they could not supply them. Would they have been worse, would the empire have been poorer, if a patent office had existed and an invention could have been protected? The remedy, then, for too great a population was that of Malthus propounded in later times, and his admirers in our day.

Now, it is hardly necessary that we should allude to times nearer our own, but it may be well to direct our readers—those at least who delve into the musty soil of history—to the condition of our mechanics less than one hundred years ago. These readers will see the wonderful difference between the condition pecuniarily and the position socially of the mechanics of that time and those of the present.

In 1769 a carpet on the floor was unknown, except in the houses of the magnates of the church or state, and at that time they were one. In the Plymouth Colony, in that year, one of the deacons (then like our present ministers, ordained to baptize and conduct religious services) was brought before a committee of his church in a town in Eastern Massachusetts and roundly reprimanded by his pastor for "presenting before ye congregation of ye w^{ch} he was an honoured officer ylch an yxample of luxury as best befitts yee times of ye ungodly of England" and was suspended for his daring, although the carpet, which was the head and front of his offending, was the handiwork of his dame and daughter.

Have we progressed since that? And is the progression, if made, to be attributed more to religious tolerance than to mechanical invention? Here is a nut for our Malthusian philosophers to crack. The world of eighteen hundred years ago contained all the means for man's comforts it does now—possibly more. We have found out not only what the earth contains, but we have found out the means of getting at it and using it. We with our Briarean arms of labor-saving utilities can afford to sneer at the Roman patrician of eighteen hundred years ago, and offer to his despairing slave not only freedom from his bonds of iron and steel that bound his limbs or prevented his freedom, but an equal right with his patron, or master, in the present possibilities, and in the magnificent future, for himself and his. And why? Because science and mechanical skill has made the impossible possible; because labor-saving machinery has not only opened new fields for the exercise of his faculties, but has provided with its iron fingers what he never could hope to provide for himself.

KEROSENE OIL.--REPORT OF PROF. CHANDLER TO THE METROPOLITAN BOARD OF HEALTH.

We reproduce the salient points of a report lately made by Prof. C. F. Chandler to the Metropolitan Board of Health, of New York, not particularly because it presents any new facts or suggestions, but because it deals with a subject to which we have repeatedly called attention in these columns, and recognizes the importance of a matter to which we have devoted much thought and given much space in our paper, as we deemed it of great and general importance. Prof. Chandler says:

The burning fluid sold so extensively throughout the United States under the name of kerosene oil, is refined petroleum from the oil wells of Pennsylvania, Ohio, Virginia, Kentucky, and Canada. As it comes from the wells petroleum is generally of a dark yellowish or greenish brown color, and possesses an odor more or less offensive. To render it salable it is subjected to a process of refining by which it is rendered almost colorless and freed as much as possible from its disagreeable odor. One of the most important objects of the purification is, however, the separation of the more volatile constituents, the benzine, keroseline gasoline, or naphtha, as they are variously called. These liquids, being very volatile, and, at the same time, very combustible, are the substances which give rise to the explosions which render the use of kerosene so dangerous. Benzine being the cheaper article, the cupidity of the refiner leads him to leave as much benzine in the kerosene as possible, regardless of the frightful consequences. Native patroleum is a mixture of a great number of hydrocarbons, compounds of hydrogen and carbon. These differ from each other in volatility. Some are so volatile as to evaporate rapidly at ordinary temperatures, making it dangerous to approach an open tank of petroleum with a flame. Others are much less volatile, some requiring a temperature of 700 to 800 degrees Fah. to vaporize them. The volatility of these component hydrocarbons is intimately related to their specific gravity or weight, the lightest oils being the most volatile, while the heavier oils possess the high boiling points. The inflammability of the oils is also intimately connected with their volatility and specific gravity. The light volatile oils ignite on the approach of a burning match, no matter how cold they may be; while the heavy, less volatile oils can only be ignited when they are heated above the ordinary temperature of the air.

The crude petroleum as it comes from the wells is subjected to distillation, when the most volatile constituents pass off first in the form of vapor, and are condensed by passing through a coil of iron pipe surrounded by cold water, and collected as benzine; subsequently the burning oil or kerosene makes its appearance; this is followed by a heavier oil which may be used for lubricating machinery; and there is finally a small residue of tar or coke left in the still. That portion of the product which is designed for illuminating oil is then subjected to the action of sulphuric acid to remove the odor and color, and destroy a little tar which it still contains. It is then subjected by the more careful refiners to a somewhat elevated temperature to expel a small percentage of benzine which it still contains. Thus purified it constitutes the kerosene oil as it is sold in the market.

The conscientious refiner runs all the dangerous oil into the benzine tank, and only when the oil is sufficiently heavy to be safe does he allow it to pass into the kerosene receiver. But as the benzine must be sold at a lower price than burning oil, the refiners are many of them led to collect as little benzine and as much kerosene as possible. It must not be supposed, however, that the specific gravity of the oil can be considered a safe index to its quality. On the contrary, the specific gravity gives very little idea of the quality; for while benzine and naphtha render the kerosene lighter, the gravity of good kerosene is preserved by the presence of heavier oils. So a poor, dangerous oil may be much heavier than a safe oil.

As the products of petroleum are dangerous in proportion to their inflammability, a fire test has long been in use, by which the temperature is determined at which the oil evolves an inflammable vapor—the "vaporizing point"—and the temperature at which the oil itself may be handled with a burning match—the "burning point." The vaporizing point of good kerosene oil should not be much below 100 degs. Fah., and the burning point should not be below 110 deg. Fah. Unfortunately the results of this investigation show but little of the oil sold in New York comes up to this standard.

Processes have been patented, and venders have sold rights throughout the country for patented and secret processes for rendering benzine, gasoline, and naphtha non-explosive. Thus treated, it is sold under such names as "liquid gas," "aurora oil," etc. These patents and secret processes are not only ridiculous, but their sale to ignorant persons is a crime only equaled by murder.

The fire test gives the only sure indication. Apply a lighted match to a little of the oil contained in a cup or saucer, and if it can be made to take fire, it should at once be considered unsafe, even though the experiment be made in one of the hottest days of summer.

Seventy-eight samples of kerosene oil have been procured from the same number of kerosene dealers in different parts of the city, and these have been carefully subjected to the fire test to determine the vaporizing and burning points. Several of the samples have also been subjected to fractional distillation to determine the proportions of benzine and naphtha which they contain. The result was that not one of the seventy-eight samples, selected at random throughout the city, which are all that were tested, is of a good quality, which may be called safe. The only single specimen of safe oil in the entire list is manufactured in Boston.

It is a little singular that Prof. Chandler should have been so unfortunate in the samples of kerosene he obtained. If he is correct, the surprise is not that occasional explosions, and consequent injuries, occur, but that such are not reported almost daily. Several months ago we made repeated trials and tests of kerosene obtained from our family grocer in Brooklyn, and in no case did we find the kerosene below the legal and practically safe test. We could mention the names of refiners of petroleum who would scorn to attempt such a murderous imposition on the public, or such a fatal stroke at their business name as to send out an improperly distilled or refined product. The test is so easily made and the law is so explicit that either manufacturer or dealer should find his attempt to impose on the public a spurious, dangerous, or inferior article a sad and serious failure.

No one possessed of common sense, a thermometer, a saucer, and a match, need ask anybody's opinion as to the explosive or dangerous quality of the kerosene he uses. The facts in regard to the character and tests of the fluid have been repeatedly published in the SCIENTIFIC AMERICAN, and it adds nothing to the importance of the subject that professional chemists should write, and daily papers print, a rehash of facts long ago sufficiently plainly stated.

Foreign Contracts for American Guns.

The gun-making ingenuity of Americans seems to be appreciated in Europe almost as much as that of the Prussian or French, if foreign orders for American fire-arms are any indication. The *Sun* says the Remington Company has recently delivered to the Danish government, 40,000 of their guns, and to the Swedish government 30,000, and the Greek government has contracted for 15,000 which have not yet been delivered. The Remington pattern is a single cartridge breech-loader of superior make and efficiency, of which from 200 to 300 are turned out daily by the Company. The Cuban government has bought upwards of 20 000 of Remington and Peabody rifles, the latter an arm manufactured in Providence. The Cuban revolutionists also have been buying up a large quantity of small arms, but of a poorer class, chiefly muzzle-loaders, being unable to pay for better ones. They hope to achieve their independence with the odds of breech-loaders against them. The Russian government has a contract with the Colt Fire-arms Company at Hartford, for 30,000 rifles, an improvement on the Prussian needle gun.

Besides the above contracts, shipment of guns to other governments have been made by American firms. The standard arm of the United States Government, is the Springfield musket, converted into a breech-loader, upon what is known as the Robert plan. It is a beautiful and very effective piece, and is admired by the ordnance departments of foreign governments. The regular army is now supplied with them. The great quantity of muskets which our Government had on hand at the close of the war is being disposed of at auction and private sale.

The only repeating rifles now made in this country are the Winchester at Bridgeport and the Spencer at Boston. The former is an improvement on the celebrated Henry rifle, carrying eighteen shots, and can be fired with great rapidity. The latter is a seven-shooter, and in Sherman's campaign through Georgia six men on a picket post armed with the Spencer carbine kept at bay for some time a whole battalion of the enemy by the rapidity of their firing. These repeating rifles are used for hunting on the Plains, and meet with much favor in foreign countries. American gun makers regard the famous Prussian needle gun as inferior in every respect to our best patterns.

PRIMEVAL CHEMISTRY---LECTURE BY PROFESSOR J. STERRY HUNT.

Reported for the Scientific American.

Professor Hunt, of Montreal, delivered the eighth lecture of the scientific course before the American Institute, on the evening of the 14th instant. Subject, Primeval Chemistry. Whatever may have been the opinions of his hearers in regard to the peculiar views of Professor Hunt, all will concede the singular ability with which he maintains them. The lecture, although from its subject, a dry and abstruse discussion might have been anticipated, proved, on the contrary, one of great popular interest, both on account of the order in which the points were arranged and the happy method of illustration employed by the speaker. We have only room for an abstract of the lecture, but we shall, as far as we can, give its leading features.

Upon his introduction to the audience by Judge Daly, Professor Hunt said:

MR. PRESIDENT, AND LADIES AND GENTLEMEN: You have already been informed that the subject of this evening's lecture is Primeval Chemistry—the chemistry of the earlier condition of the world's history—chemistry before there were chemists, before there was any eye, except the eye of the great All-seeing One, to investigate or to study His marvelous phenomena. As this has reference more especially to the history of this earth, it may be well spoken of as chemical geology, a term which has been very frequently applied. We speak of geology as if it were a science, but in reality under that name we include a whole group of sciences. In the first place, to the astronomer this world is one of a system revolving around our sun—the so-called solar system—and that so-called solar system is but one of many more such great systems, thus occupying a very insignificant position in the great cosmos. Thus our world appears to the astronomer. To the physicist, again, who studies it in relation to the laws of gravitation, with regard to the laws of light, it appears altogether in another light. Then comes the chemist, who examines the relations of its rocks, its waters, and its atmosphere. He has also his history of the globe. Then comes one who studies the changes in its crust, the movements which give rise to mountains, which cause all the geographical diversities of the earth's surface. This has been discussed before you by my distinguished predecessor, Professor Hall. Later, comes a period in the history of the planet, in which life appears upon the surface, animal and vegetable. Already Dr. Dawson has explained to you the laws which govern the evolution of vegetable life, how during successive periods, successive creatures, flora after flora, each more beautiful and more perfect than its predecessor, appeared upon the surface of the planet. Then again comes the zoologist, who investigates the various forms of animal life. All these studies, beautiful and important as they are, are mere branches of that great complex study which we call geology. Professor Hunt said he would merely discuss the chemical relations of our globe, but he must to a certain extent go outside of our globe, because he must look at it from the astronomer's point of view. The chemist had to look to the rocks, the waters, and the air; but behind all these came in another question, whence was the origin of rocks, of water, and of air? There must have been a time when these were not, and the first question of the student was as to the origin of these things. It was the rare privilege of the scientific eye to look backward, to solve this problem, and to learn, as it were, the history of these pre-historic times. From the astronomer, who recognizes the fact that our globe is but one of many worlds, there comes in a strange and unexpected light to aid us, and physical science here contributes most curious stores of knowledge. Speculating upon the origin of our earth, and seeing the curious harmony which existed between its motions and those of its satellites, and of the other planets that moved around the sun, the great Kant was induced to ascribe a unity of origin to all. Later, the idea was developed by La Place, who supposed that from a great nebulous cloud existing in space there was formed, in accordance with certain physical laws, successive planets, successive satellites, the sun finally remaining in the center; the result of the condensation of one immense cloud of vapor, for whose origin, still further back, we must only look to the great Author of existence, who created it, and imposed upon it the laws which, in after ages, regulated its development. This great nebulous cloud rested in this condition until Sir William Herschel, in studying the skies, examined certain masses of light which had before been known as certain cloudy, milky masses of white light. He viewed them with his great telescope, and was unable to resolve them. Here he said, "I have the origin of this cosmic matter; here I really see the stuff of which worlds are made," and he described them as so many nebulæ. Later astronomers looked at the masses with more powerful glasses and were able to resolve many of them into groups of stars. For instance the great milky-way which we observe so plainly in a clear, cold winter's night was found on close examination to be made almost entirely of little stars which came out under our brightest telescopes. Still there were certain masses of light which Herschel could not resolve, but which other observers discovered to be made up of suns or of stars, and hence the nebulous hypothesis fell into doubt. It was said as some of the supposed nebulæ have already been shown to be composed of stars, still more powerful instruments will enable us to show that these nebulous masses are made up of stars. Just at this point came in a very unexpected aid in the spectroscope. With this instrument, in the examination of light in the first place from terrestrial sources, it has been found that you can discriminate between the light that comes from a solid body and the light which comes from a vaporous, or gaseous body—that you can pierce distance and resolve problems, for the investigation of which the most powerful telescope was impotent. We have now discovered that in the sun and in the fixed stars we have present the very same elements as those of our earth, and we may hence conclude that the same chemical laws which hold good in our planet hold good in the bodies of the solar system. We might, therefore, conclude not only the unity of our system, but the unity of all systems, and all worlds, and we are enabled by comparison between these and our own planet to show that all these nebulæ, suns, and planets, are worlds in so many successive stages of development, of which our own is perhaps one of the latest and most complete. Having determined this great luminous or nebulous mass, the natural inquiry is what are the laws which regulated its condensation; how should it ever become reduced to the condition of a solid globe? By the simple process of cooling. The sun, the great center of our system, was and is a cooling body. It is a body constantly giving off light and heat, and therefore slowly but surely undergoing a cooling process. When we investigate the laws of cooling bodies, and still more when we investigate the chemical changes in bodies at a greatly increased temperature, we learn another curious lesson, which is, that at intense temperatures (such heat as must exist in the sun and in the nebulæ), almost all bodies are in a state of chemical indifference. To make himself plainly understood, he would refer to the composition of water. This was known to be produced by the combination of oxygen and hydrogen gases. These combine with an evolution of heat to produce water, but if you exposed water to a very much higher heat than that by which it is formed, it will break up again into oxygen and hydrogen. So we find that almost all compound bodies known in nature, when intensely heated, are decomposed. It seems as though the chemical affinities, which brought them together and tended to make them a unit in combination, are completely suspended at these higher temperatures, so that one may well suppose that on the sun, and still more in these nebulous bodies, all the elements are in a state of chemical indifference. The spectroscope told us that, because we recognized the spectra of the simple elements, and not of the compound bodies. The process of condensation going on in the sun, and which surrounds that body with an envelope of luminous mist, is going on in all the planets. Our earth was once a luminous mass of vapor, passing through a stage in which it was self-illuminating like the sun, until it finally became cool to such a point that it liquefied and became at last solid. Many suppose that this great liquid earth was surrounded first by a solid crust; but there is no evidence to prove that the cooling began at the center, and proceeded outward to the outer surface. This question is interesting to us from more than one point of view; it has an important bearing upon many facts connected with the changes of the earth's crust; the question as to whether this solid surface upon which we walk rests upon a liquid molten rock, or whether we have a solid mass through to the center. This subject has been extensively investigated by physicists, and has given rise to many differences of opinion. We must either regard the earth as solid to the center, or, if not solid, the crust must be many hundred miles in thickness, as the laws spoken of have operated from the beginning; and the vast masses of solid matter would arrange themselves at the center of the globe, while the surface would be covered by a thin layer of liquid matter, and this acted on by the internal heat would naturally assume the uneven character of the surface of our primeval globe. So far as the chemistry of our planet is concerned, we have only to deal with the outer crust. In this we find granite, quartz, limestone, gypsum, coal, and the various metals, and the waters of the ocean, and all these surrounded by the still lighter atmosphere. We must understand that these elements must have been formed from the materials which were near the surface and in the air. There, of course, could have been at one time no water. The high temperature of the mass rendered its existence impossible. Then there was no ocean. We must, therefore, restrict the primitive crust to the solid rocks, and the atmosphere with its gaseous contents. Thus we may form a just idea of what that early crust consisted, if we suppose the atmosphere and the ocean to be brought together at the intensely high temperature which then existed.

Suppose the earth to be now melted with fervent heat. Every chemist can readily see that by bringing together the limestone and the waters of the ocean under such conditions, sulphur also being present, the sulphur, the chlorine, and the carbon would be transformed into gases; the alkalies, lime, alumina, and magnesia, would unite with the acid gases to form sulphates, carbonates, and chlorides, while the metals, with silica and alumina, would combine in the crust to form a substance similar in composition to what are now known as slags, and over and above this an atmosphere, charged with acid vapors—sulphur and carbon in the form of gases, and water in the form of steam, mixed with the elements of the atmosphere, nitrogen and oxygen, and carbonic acid, or the elements of carbonic acid in the free state. Under these conditions the atmospheric pressure would be immense, and the barometer would stand three or four times as high as it now does. Under the pressure of such an atmosphere, water and the less volatile materials would be precipitated upon the rocks. This water would, of course, be strongly charged with acids—hydrochloric and sulphuric—and being fluid, would fill the cavities and spaces in the solid earth. The result would be, at this high temperature, to give rise to the immediate decomposition of the silicates and carbonates, and set free the whole of the silica, while the acids would combine with the lime, magnesia, soda, and many of the metals; chlorides and sulphates would be formed, while the silica, separating, would form quartz. The salts of lime, magnesia, and soda would dissolve in the water, and form sea water. The activity of the combinations would gradually become less violent, as the affinities would be rapidly satisfied. The acids would combine with the rocks until they got their full equivalent, and then would commence a new process. A process of slow decomposition by air and water would now set in. Carbonic acid and water would attack the silicates, and take the lime from them; clay, bicarbonates of soda, etc., would be formed, which, dissolving, would find their way to the sea, where chloride of sodium or common salt would also be formed. This action is still going on upon the felspatic rocks, decomposing the strongest quartz and making clay, though much less rapidly then formerly on account of the diminished quantity of carbonic acid in the atmosphere. Every lump of clay then upon the earth's surface represents granite decomposed, limestone formed, and salt added to the sea.

Until the acids were in a great measure removed from the atmosphere, animal and vegetable life was impossible. Professor Dawson has told you that vegetation was one of the most powerful agents in removing carbonic acid from the atmosphere; but I believe that a very large quantity of it must have been first removed before vegetation could have taken place.

Another curious question solved, if these views are correct, is the fact that in the polar regions, where there is now little or no vegetation whatever, there existed in former ages plants now confined to the tropics. Many hypotheses have been framed to account for this change of climate; but the true solution is undoubtedly to be found in the composition of the atmosphere at this period—the mixed gases heretofore described. These gases imprisoned, so to speak, the sun's heat, so that the earth might be compared to an immense greenhouse. The high temperature at the poles was then the consequence of impeded radiation.

Beside the chemical forces already named, there succeeded of course mechanical forces, described in a previous lecture by Professor Hall, until finally the whole surface of the earth became nearly covered with sedimentary deposits. I deny that at this period the interior of the earth was in a fused condition; but I admit that its temperature was very high—as hot as it could be and remain solid.

The surface of the earth receives but little heat from the interior at present, not enough to change its temperature more than one degree, but as we descend into mines we find an increase of temperature. The loss of heat from the earth's interior diminishes daily, and the increase which would have been felt in descending was formerly ten times as great as now. The result of this high temperature was crystallization and new combinations. Hence the origin of the metamorphic rocks, which are sediments changed in character by crystallization. If I had time, I think I could show you that the White Mountains of New Hampshire were originally of the same age and composition as the Catskills of New York. The mountains of New England have had their rock masses changed by the action of heat.

Granite has been supposed to be the primitive rock. This is a fine theory, but we really know as little of the primary nucleus of the earth, as we do of the other planets. Granite is a rock, derived from quartz. Quartz cannot be formed by heat, it is only formed by water. Quartz when heated ceases to be quartz, so it will be seen that what were supposed to be primitive granites, are not primitive, but derivative rocks.

This can be determined by the microscope, which not only shows the origin of the rock, but the very temperature at which it was formed. The crystals are found to contain cells inclosing water, when this water is heated to a temperature at which it exactly fills these cells, that temperature must be the precise temperature at which these rocks were formed. This temperature has been determined to be below that of melting lead.

The question now arises, how these rocks were softened. To answer the inquiry it will be necessary to consider the relations of pressure to the melting point of bodies. It has been found by Tyndall and others, that ice melts more easily under pressure, than otherwise. But ice is in this particular, as in some others, an exception to solid bodies in general. Most bodies expand in liquefaction, so that pressure raises the melting point of bodies. Thus pressure tends to solidify the center of the globe. Solution resembles in many points, the fusion of solid bodies, but every solution is denser than its ingredients. Hence pressure favors solution, while, with the exception of ice, it retards fusion. It will be seen then how water penetrating deeply into the crevices of the earth's crust, and there acting under enormous pressure would soften obdurate sediments, and—a point made for the first time here to-night—aided by the contraction by cooling of the deply buried sediments, which, tending to open crevices of great depth, gives rise to the yielding bed upon which the earth's crust now rests, and so also the oscillations and other phenomena of volcanic action. Did time permit, I would like to show how the precious metals remained suspended until finally they were deposited in veins and gangues, as now found, but I forbear. I think I have said enough to show that the proper commencement of geological science is chemistry.

Why Boilers Sometimes Explode.

The last number of the *Locomotive*, published by the Hartford Steam Boiler Inspection Company, gives the following somewhat startling summary of inspections made by its inspectors during the month of December: One hundred and eighty-two visits of inspection were made, three hundred and forty-one boilers examined externally, seventy internally, thirty-four tested by hydraulic pressure. In these boilers one hundred and sixty-eight defects were discovered, thirty-two being sources of special danger. Among them we enumerate the following: Six furnaces out of shape, thirteen fractures—three dangerous, six burned plates, twenty-four blistered, seven dangerous, thirty-one cases noticeable incrustation, twenty seven boilers corroded externally, five dangerous, seven boilers grooved internally, five safety valves overloaded—three dangerous, five blow-out apparatus out of order—three dangerous, thirteen water gages out of order, twenty-two pressure gages out of order—three dangerous, two boilers without gages, six cases of deficiency of water, three boilers had stop-cocks between safety valve and boiler—a dangerous apparatus, one boiler had no safety-valve, one had no feed pipe, three were cracked entirely around the shell. One was blistered so that the Inspector pushed his finger through the shell, after cutting off the blister. One was corroded through from accumulation of ashes, combined with small leak. One gage-pipe was completely stopped up. One boiler was so badly burnt, blistered, cracked, etc., as to give out entirely under pressure. These boilers were all in actual use.

Voice From the South.

Perhaps in the whole range of exchanges that come to our table, there is none more welcome—while there is certainly none more useful—than the SCIENTIFIC AMERICAN. Devoted to explanation and discussion of all the most novel improvements in science, mechanics, and arts, which are rendered plain and easily understood by admirable cuts, this paper has a high mission which it fulfills with exceptional ability. It has that novel quality, too, of minding the business for which it set out, and eschews politics most carefully. It is perhaps this fact, as much as its very great ability, that has for years given this paper the high standing it has among the business, manufacturing, and scientific men of the country.

Munn & Co. who own the paper, are everywhere known as thoroughly experienced and successful Patent Agents. They are prompt and reliable; and we can state of our own personal knowledge, that any such business entrusted to them will be perfectly certain to give entire satisfaction.—*Mobile Daily Register*.

The Value of Small Inventions.

The great value of some of the smallest inventions is strikingly illustrated in the success of the Bag Fastener, recently patented by Charles M. Nye, of Elizabethport, N. J. It is only three months since the issue of the patent, and he has already received cash orders for over $60,000 of the Fasteners, and several offers of $10,000 for the patent, which he declines. He has established a factory capable of turning out 15,000 of the article per diem. The Fastener consists merely of a couple of small leather straps, united by a central buckle. One customer in Philadelphia orders them by the ten thousand, and says that they save him $50 a day in cash. A man can securely fasten a dozen bags of grain in the time that it ordinarily takes to tie a single bag. The millers like the improvement, and it is coming into extensive use. Patented through the SCIENTIFIC AMERICAN office.

The New Breech-Loader.

The work of preparing tools for the fabrication of the new breech-loader, which is to be made at the Springfield (Mass.) armory, is being rapidly forwarded, the machinists, at the request of the commandant, working ten hours a day for that purpose. When everything is ready the making of the new model will begin at once, and a larger force than the present one will necessarily be employed, in order to furnish the army with the improved breech-loaders as rapidly as they are called for. In anticipation of this demand for labor many of the former workmen at the armory are returning and entering their names and addresses on a book kept for that purpose, so that the authorities can send for them when they are wanted.

Experiments by Professor Tyndall.

At a recent meeting of the Photographic Section of the American Institute, Professor Joy read the following extract from a private letter which he had received from Professor John Tyndall:

My daylight hours have been recently occupied with the question of the chemical action of light upon vapors, and also with the blue color and polarization of the sky. These questions, which have been so long the great enigmas of meteorology, have, I hope, at length been brought within the grasp of experiment, and have been, to a great extent, satisfactorily solved. The condensed summary of my results is at the present moment in the hands of Sir John Herschell, who has manifested great interest in the inquiry. As soon as he sends it back to me I shall hasten its publication, and it will give me great pleasure to send you a copy of it. J. TYNDALL.

ARCHITECTURE AND BUILDING.—We intend to devote considerable attention during the year to the subjects of architecture and building, and shall endeavor to furnish information that will be useful and interesting to all our readers.

Bridging the Connecticut River.

The subject of bridging rivers for railways purposes is still agitated. It is proposed to bridge the Connecticut River at Lyme and at Middletown, and the Connecticut Legislature has authorized the construction of the bridges. The matter has been carried before Congress for confirmation. It is claimed that by bridging the river at Middletown the distance by rail from New York to Boston will be shorter twenty-six miles.

Connecticut interests oppose the interference of Congress and the building of the bridges, for the reason, among others, that they will obstruct the navigation of the river. There is apparently a big "lobby" on both sides. We predict that in the end the bridges will be built.

Editorial Summary.

Mr. George W. Blunt has issued a notice cautioning masters of vessels passing Hell Gate of the danger of collision with the vessel at work removing the obstructions at that point. He says: "It is a settled fact that masters and owners of vessels colliding with the contractor's tug and machinery at work over Frying Pan must make full indemnity for the damage done. It is also important, for public reasons of humanity, that collisions should be avoided, as large quantities of nitro-glycerin must be kept constantly on the spot, and liable to be exploded by the shock of percussion, which would be highly destructive to human life in case of collision." Mr. Shelbourne, the contractor, particularly requests the pilots of the Sound steamers to slow their engines in passing the point of his operations. Regular work on Frying Pan commenced on Monday, January 11.

Social Science Association.—The annual meeting of the American Social Science Association will be held in Albany in February, under the direction of the District Committee, among whom are General John Meredith Read, Jr., Chairman; Thos. W. Olcott, Treasurer; Charles E. Smith, Secretary; John V. L. Pruyn, William Cassidy, Jas. Hall, Erastus Corning, Hon. Ira Harris, S. B. Woodworth, John H. Reynolds, the Hon. Amasa J. Parker, J. H. Armsby, Benjamin Nott, Dr. S. O. Vanderpoel, William A. Rice, Dr. James McNaughton, R. L. Banks, Orlando Meads, John H. Van Antwerp, Geo. Dawson, Hamilton Harris, John F. Rathbone, and William H. De Witt. Papers will be read by General Garfield, John Stanton Gould, Professor Goldwin Smith, President Samuel Eliot, and other distinguished gentlemen.

The New York "Journal of Medicine" says that Dr. N. Hickman, Demonstrator of Anatomy in the University of Pennsylvannia, has met with a case of complete transposition of the internal organs in the dissecting room of the university. The apex of the heart is on the right side; in fact every organ occupies exactly the opposite side from what is natural. This may be cited as a good case of total (physical) depravity.

Melting Snow with Salt.—Persons are in the habit of sprinkling salt upon snow before their doors. They could not do a more silly or injudicious thing. The result is to change dry snow or ice at the temperature of 20° to brine at 0. The injurious effect of damp upon the feet at this excessive degree of cold is likely to be extreme. The practice is prohibited in this city.

Oranges were frozen solid on the trees, at Augustine, Fla. on Christmas day. The weather was the coldest known in that locality since 1865. The thermometer at daylight stood at 20° above zero. It afterward touched 17°. In a climate where even white frosts are unusual, this was very severe. Last year, at the same time, the Florida ladies were dressed in lawns.

It is said that the Sutro Tunnel has been considered by the Committee on Mines and Mining since the opening of the session, and a favorable report is expected. The plan has been somewhat modified. It now contemplates the guarantee of bonds by the Government to the amount $5,000,000, and the raising upon this basis $12,000,000 in Europe.

Polished Plate Glass.—A correspondent writes to know why polished plate glass is not manufactured in the United States.

Ans. Want of good material, cheap skilled labor, and capitalists to invest in a business involving a good deal of risk.

The recent thaws have broken up the ice, and produced a disastrous freshet at Albany. Large quantities of grain have been lost, and the piers along the river front so undermined, that the buildings resting on them are insecure. Some have already fallen.

A convention has been held at Peoria, Ill., to consider the improvement on the Illinois river. It is proposed to seek aid from the State in addition to the appropriations made by the general Government to carry on the work.

A Boston paper asserts that a Portland mechanic has made a fine cambric needle which can be unscrewed, and contains in a hollow within another smaller one. This is a delicate piece of work, but by no means without precedent.

Siemens' Furnace.—We are having inquiries about the above furnace which we are unable to answer. Parties interested will do well to advertise in our paper.

The new suspension bridge at Niagara has been opened to public traffic. It is said to have the longest span of any bridge on the Continent.

Recent American and Foreign Patents.

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

Gage for Sewing Machines.—Mrs. Anna P. Rogers, Quincy, Ill.—This invention consists of an adjustable gage plate having a recess in its front edge, in which a presser pad, having inclined serrated grooves on its lower face, is arranged and connected to the said gage plate by an adjustable spring which governs the pressure of the pad upon the cloth.

Railroad Car Oil Box.—John C. Creed, Omaha, Neb.—This invention consists of an improved form in which the box and its cover are cast, whereby when the one is hinged to the other by a single pivot, a close-fitting joint is obtained without the expense of other finishing.

Water Elevator for Stock.—D. J. Keller, Kane, Ill.—The nature of this invention relates to the elevation of water for the purpose of supplying stock. The general features of the invention consist of a hinged platform upon which the animal steps to approach the trough, and the weight of the former causes the platform, through the interposition of proper mechanism, to compress a water bellows which forces the water into the said trough.

Extension Table.—G. S. Manning, Danville, Ill.—This invention relates to a new and useful improvement in extension tables, whereby the table is rendered much more convenient and useful than extension tables of ordinary construction. The invention further consists in so forming the table that the parts may be separated and a number of separate tables formed thereby.

Oven.—Charles H. Finn, Syracuse, N. Y.—The object of this invention is to provide means for determining at all times the temperature of baking ovens, cooking stoves, and ovens in other situations; and it consists in attaching to the doors of such ovens a thermometer, in such a manner that the bulb of the thermometer shall be inside the oven, while the scale and tube shall be on the outside of the door or visible to the eye.

Cotton Gin.—A. A. Porter, Griffin, Ga., has just patented a new and improved cotton gin, which is said to be an important improvement. The invention consists in an improved arrangement of means for causing the cotton being fed into the gin to have a to-and-fro movement in a lateral direction, for bringing it more perfectly into contact with the saws, thereby more thoroughly separating the seed, and, at the same time, working the fiber evenly. Mr. Porter is desirous that planters should investigate and test the merits of his machine confident that his invention will be a benefit to them.

Smoking Pipe Mouthpiece Attachment.—J. P. Courtney and William H. Kelagher, Brooklyn, N. Y.—This invention relates to improvements in smoking pipes whereby the salvia or liquid from the mouth of the smoker is prevented from entering the stem or tube of the pipe.

Cartridge Box.—John I. Pittman, New York city.—This invention relates to a new and improved cartridge box, designed more especially for holding metallic cartridges. The object of the invention is to obtain a simple and economical means whereby the cartridges may be firmly retained in proper position in the box, readily withdrawn from the latter as required for use, and the proper or usual number allowed to put into the box.

Joints or Connections for Railway Rails.—Charles H. Crosby, Boston, Mass.—This invention relates to a new and useful improvement in that class of joints and connections for railway rails, in which screw bolts pass transversely through plates placed at both sides of the rails and also through the rails.

Stalk Cutter.—R. B. Parks and J. R. Parks, Neponset, Ill.—This invention relates to a new and improved machine for cutting the standing stalks of Indian corn or maize into short lengths, so that they may be left upon the ground and plowed under, and cause no difficulty or trouble in the cultivation of succeeding crops.

Fence.—J. J. Reicherts, Delaware, Ohio.—This invention relates to a new and useful improvement in fences for door yards and for all other purposes to which the same may be applicable.

Gate Latch.—J. A. Martin, Strasburg, Pa.—The object of this invention is to provide a simple and effective gate latch which is not liable to get out of repair, and which supports part of the weight of the gate.

Blind Fastener.—Simon F. Stanton, Manchester, N. H.—This invention relates to an improvement in fastening window blinds (either closed or open), and it consists in attaching a semi-circular notched bar permanently to the window frame, and a spring bolt to the blind, whereby the blind is securely held entirely closed, or in any desired position when open.

Press.—J. Berkeley, Washington, Texas.—The filling and pressing chamber is divided into two parts, one of which is fixed to the wagon frame near the front end in a permanent manner, the other part to which the material is supplied to be passed, and which is provided with the follower, is arranged upon trunnions near the rear end of the wagon and is turned on the same with the rear end down to be filled; when filled it is restored to the level of the frame, and communicates with the fixed portion into which the material is forced by the follower, which is operated by a windlass and cords working over pulleys properly arranged. The sides of the fixed portion are arranged to open to discharge the bale.

Derrick.—Angus Campbell, Downieville, Cal.—This invention relates to various improvements on derricks, whereby the operation of loading and unloading articles from and into ships, and other receptacles, can be greatly facilitated. It also consists in the use of a truck which slides on the boom, also in the application of an endless rope for bracing the boom without interfering with the motion of the truck, and without overstraining the topping lift.

Composition for the Cure of Hog Cholera.—W. B. Robuck, Oxford, Miss.—The object of this invention is to provide for public use a cheap specific for hog cholera.

Goblet.—Thomas Leach, Taunton, Mass.—In this invention the bowl of the goblet is of glass and the standard of silver, or other metal, the two parts being connected by a screw joint, so that they can readily be taken apart, in order that, if the bowl should get broken, another may be inserted in its place, and thus a new goblet be produced at a comparatively slight expense.

Gang Plow.—Wm. Mason, Independence, Oregon.—The object of this invention is to construct a simple and strong gang plow which can be more easily and conveniently operated than those now in use.

Hay and Cotton Press.—Elias Evans, Montgomery, Ala.—This invention relates to that class of hay and cotton presses in which the bale is formed at the top of the press box, and consists in an improved apparatus by which the cover of the box can be swung out of or into place with greater convenience and dispatch than heretofore.

Evaporating Apparatus.—Elijah Chitister, Chatham, Iowa.—This invention consists of a furnace arranged in three or more sections and provided with ways for sliding the pans transversely over the furnace, and provided also with suitable pans, which, after being charged with the liquid to be evaporated, are placed on the furnace and transferred from one section to another, where fires of varying intensity are maintained, in the order calculated to produce the best results.

Process for Bleaching Ivory, Bone, and other Similar Articles.—D. K. Tuttle, New York city.—This invention relates to improvements in the process of bleaching ivory, bone, and other similar articles, and has for its object to cheapen the cost and improve the quality of the articles bleached, and it consists in exposing the said articles to the action of light in a bath of spirits of turpentine.

Harness Cock Eye.—S. D. Bingham, Maumee City, Ohio.—This invention has for its object to furnish an improved harness cock eye, simple in construction, durable, easily adjusted, and which will diminish the cost of the construction of the harness very materially.

Seed Planter.—John S. Robb and Samuel P. Allison, New Cumberland W. Va.—This invention has for its object to furnish an improved machine, designed especially for planting potatoes, but which shall be equally applicable for planting all other seed requiring to be planted in hills or drills, and which shall be simple in construction and accurate in operation.

Burglar Alarm.—M. Pierson and M. D. Manville, Adams, N. Y.—This invention has for its object to furnish an improved alarm for attachment to doors, windows, drawers, etc., which shall be so constructed and arranged that it shall be impossible to open the door, window, or drawer to which it is attached without a continuous ringing of the alarm.

Plow.—Samuel Prentiss and George Flint, De Soto, Mo.—This invention has for its object to furnish an improved plow, simple and durable, which may be used with equal facility for breaking up new ground, for plowing old or cultivated ground, or for subsoiling, and which can be run at a greater depth, with less draft than is possible with the ordinary plows.

Land Rollers.—Neal S. McLay, Olathe, Kansas.—This invention has for its object to furnish an improved land roller, which shall be so constructed and arranged that the rollers may adapt themselves to rough or uneven ground, so that the entire surface of said ground may be suitably rolled.

Cultivators.—John G. B. Gill, Chester Court House, S. C.—This invention has for its object to improve the construction of the cultivator known as the "Buckeye Sulky Cultivator," so as to make it more durable and more convenient.

Iron Frame Gate.—W. F. Whitney, Milwaukee, Wis.—This invention has for its object to furnish an improved gate, which shall be light, strong, durable, simple in construction, and adapted to any situation.

Weighing Scale.—S. S. Hamilton, Taylor's Falls, Minn.—The object of this invention is to provide a weighing scale which is simple, durable, compact, and not liable to get out of repair, and which will indicate with delicacy and accuracy the weight of the article weighed.

Hydrants.—Louis W. Werner, St. Louis, Mo.—The object of this invention is to provide a hydrant which is simple, effective its operation, and easily taken up to repair or clean out when occasion requires.

Threshing Knife.—Henry Spaulding, Fletcher, Vt.—The nature of this invention relates to the form of the threshing knife usually affixed in the concave of threshing machines. It consists in forming the said knives with two cutting edges, and affixing the same to the concave in such a manner that the knives may be reversed to present a new edge when the other has become dulled from use, thereby enabling the machine to be run twice as long as when knives with only one edge are employed.

Ore Concentration by Centrifugal Force.—S. F. Pearce, 32 Dey street, New York city.—The concentration of ores by a mechanical process, without the use of water or currents of air, has been successfully accomplished by the application of centrifugal force, acting on the ore (previously crushed dry by any method), and by which it is caused to fly off from a central point and fall freely into a series of annular receivers, by which means it is separated according to its gravity, the heavier particles falling further from, and the lighter nearer to the center. A sketch of the apparatus, with a description, will be given in a future number of this paper. Patent dated August 11, 1868.

Furnace for Roasting and Calcining Ores.—Ernst Westman, of Stockholm, Sweden.—This invention relates to a new furnace for roasting and calcining ores by means of gases that are produced by the combustion of suitable fuel; and the invention consists in such an arrangement of parts, that ore of suitable quality can be perfectly freed from impurities, and that the process can be quickly and conveniently carried on.

Safety Attachment to Carriages.—Claude Ducreux, New York city.—This invention consists in so connecting the operating lever with the brake and detaching apparatus, that either the brake alone, or both the brake and the detaching apparatus can, by one move of the lever, be operated. The object is to allow the same lever to apply the brakes of the carriage or wagon moves down hill or is drawn too quick, without necessitating at the same time the detaching of the horses.

Sectional Bureau.—Elias Gill, New York city.—This invention relates to a new bureau, which is so constructed that it can be readily packed together into a small compass when to be transported from one place to another. The invention consists in constructing the bureau of a series of sections or boxes, of which the upper ones are made smaller than the lower, so that each box or section can be packed into that immediately below. Each box has sliding or other doors in front or side, to allow access to its contents. The lower section is provided with a removable back or cover to allow the insertion of the upper boxes, while each of the upper ones may be entirely open at the bottom.

Method of Tempering Steel.—G. Davis, Elizabethport, N. J.—This invention relates to a new manner of tempering already completed steel or other tools and articles, and consists of a mixture of sand or other neutral substance, and water, which mixture is placed into a barrel or other suitable receptacle. The sand and water are mixed in such proportions that the required temper may be produced. The tool is heated to a red heat, and is then immersed in the mixture.

Water Elevator.—G. M. Atherton, Friendsville, Ill.—This invention relates to a new water elevator, which is so arranged that the crank handle can be turned continually in one direction, and will still operate to alternately hoist up one bucket and to lower the other; and which is furthermore so arranged that the little water remaining in a bucket cannot freeze the valve to its seat, and so that the buckets will be kept separated, and will be emptied in a certain desired place, and in one certain position.

Kiln for Burning Fire-Brick Tiles and other Analogous Article of Manufacture.—Jas. Green, St. Louis, Mo.—The object of this invention is to provide a permanent kiln for burning fire brick tiles and the like with economy and facility, and consists in the arrangement of flues, fire passages, draft passages, stacks with other parts perfecting the whole.

Sewing Machine Attachment.—Mrs. Anna Rogers, Quincy, Ill.—This invention consists of an improved method of actuating an adjustable vibrating tuck creasing device and in the combination therewith in one attachment of an improved tucking gage.

Compound Levers.—John Simpson, Marietta, Ga.—This invention has for its object to furnish an improved device for converting rectilinear into circular motion which shall be convenient and effective, and less liable to become set upon the dead point than the ordinary means for this purpose.

Hydrocarbon Burner.—Louis Verstraet, Paris, France.—This invention refers to an apparatus for the direct combustion of any petroleum and other mineral oils, for the purpose of heating steam-boilers and other industrial and domestic fireplaces, and is intended to provide a special apparatus for burning the oils in a single jet by spreading them in a sheet on a furnace.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING JANUARY 19., 1868.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On filing each caveat	$10
On filing each application for a Patent (seventeen years)	$15
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Patents and Patent Claims.—*The number of patents issued weekly having become so great, with a probability of a continual increase, has decided us to publish, in future, other and more interesting matter in place of the Claims. The Claims have occupied from three to four pages a week, and are believed to be of interest to only a comparative few of our readers. The publication of the names of patentees, and title of their inventions, will be continued; and, also, as heretofore, a brief description of the most important inventions. We have made such arrangements that we are not only prepared to furnish copies of Claims, but full Specifications at the annexed prices:*

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85,721.—Corn Planter.—F. J. Ashburn, West Union, W. Va.

85,722.—Harvester.—John Barnes, Rockford, Ill.

85,723.—Harvester Rake.—John Barnes, Rockford, Ill.

85,724.—Water Wheel.—Robert Bing, May's Landing, N. J.

85,725.—Flax Boll Brake.—B. S. Burgan, Congress, Ohio.

85,726.—Mill for Grinding Sumac.—Remington G. Chase, Alexandria, Va.

85,727.—Toy Hoop.—Samuel E. Cleveland, Buffalo, N. Y.

85,728.—Butt Hinge.—Calvin Cole, Ithaca, N. Y.

85,729.—Door Tightener and Fastener.—Dennis Conlon, Portland, Me.

85,730.—Torpedo for Oil Wells.—Frederick Crocker, Titusville, Pa.

85,731.—Revolving Bench for Tinners.—William Culveyhouse, Ligonier, Ind.

85,732.—Device for Turning Street Cars.—Benjamin I. Day, Vanderburg county, Ind.

85,733.—Horse Hay Fork.—W. E. Derrick, Jordan, N. Y.

85,734.—Grapples for Suspending Horse Hay Forks.—William E. Derrick, Jordan, N. Y.

85,735.—Stone and Stump-raising Machine.—Harvey Fleming, Vienna, N. J.

85,736.—Cultivator.—Isaiah B. Gilbert, Lewisville, Ind.

85,737.—Machine for Trimming and Dressing Millstones.—James T. Gilmore, Painesville, Ohio.

85,738.—Picture Hook.—Wilmer D. Gridley, New Britain, Conn.

85,739.—Horse Hay Fork.—Levi Haverstick (assignor to himsignor to himself and Abraham W. Shuman), Manor township, Pa. Antedated December 26, 1868.

85,740.—Gage for Circular Saws.—Oliver A. Horn and William P. Horn, Addison, N. Y. Antedated January 2, 1869.

85,741.—Earth-boring Instrument.—W. T. Huntington, Washington, D. C.

85,742.—Method of Uniting Sheet Metal Plates.—Joseph Le Comte, Brooklyn, N. Y.

85,743.—Manufacture of Yeast Cakes.—Benjamin F. Lee, Sandusky City, Ohio.

85,744.—Vaginal Injection Pipe for Syringes.—Thomas Lewis, Malden, Mass.

85,745.—Cast Iron Car Wheel.—George G. Lobdell, Wilmington, Del.

85,746.—Plow.—David A. Manuel, Napa City, Cal.

85,747.—Horse Collar.—C. K. Marshall, New Orleans, La. Antedated January 2, 1869.

85,748.—Heel for Boots and Shoes.—George W. Martin, Boston, Mass. Antedated January 6, 1869.

85,749.—Method of Securing Rubber Rings or Disks to the Doors of Vats, etc.—Charles H. Mellor, Philadelphia, Pa.

85,750.—Self-extinguishing Railroad Car Stove.—John Minor, Peoria, Ill.

85,751.—Curtain Fixture.—James A. Morrison (assignor to John H. Morris and William F. Hood), Pittsburgh, Pa.

85,852.—Mortising Machine.—Peter A. Mowers, Cleversburg, Pa. Antedated January 2, 1869.

85,753.—Reversible Latch.—W. T. Munger, Branford, assignor to P. and F. Corbin, New Britain, Conn.

85,754.—Reversible Latch.—W. T. Munger, Branford, assignor to P. and F. Corbin, New Britain, Conn.

85,755.—Gate.—Michael Neudgent, Hartland, Mich.

85,756.—Clothes Hook.—O. A. North, New Britain, Conn.

85,757.—Horse Rake.—Sherman R. Nye, Barre, assignor to himself and Andrew B. Barnard, Worcester, Mass.

85,758.—Railway Frog.—Sidney Parke, Chicago, Ill.

85,759.—Door Bell.—Chester Penfield, New Britain, Conn.

85,760.—Alarm Bell.—Chester Penfield, New Britain, Conn.

85,761.—Medical Compound.—Jonathan Penoyer, Massillon, Ohio.

85,762.—Machine for Mixing Paints and Chemicals.—Robert Poole, Baltimore, Md.

85,763.—Governor for Steam Engines.—George T. Pracy, San Francisco, Cal.

85,764.—Cigar Makers' Mold.—John Prentice, New York city.

85,765.—Knitting Machine.—Jacob D. Reiff, Skippackville, Pa.

85,766.—Manufacture of Stone Ware for the Use of Chemists and Others.—Richard C. Remmey, Philadelphia, Pa.

85,767.—Car Coupling.—Adam G. Ritz, Elizabethtown, assignor to himself and John B. Carter, Hartsville, Ind.

85,768.—Sulky Plow.—John Root, Hartland, N. Y.

85,769.—Threshing Machine.—John U. Slingluff, Eagleville, Pa. Antedated December 30, 1868.

85,770.—Swage for Saw Teeth.—Joseph Sperrey (assignor to Henry Disston), Philadelphia, Pa.

85,771.—Shaft Tug.—John E. Stuber, Turin, N. Y.

85,772.—Shutter Hinge and Knob.—John W. Tripp, Gallipolis, Ohio.

85,773.—Device for Securing Fastening Loops to Neck Ties.—Benjamin F. Weishampel, Baltimore, Md.

85,774.—Hot Air Furnace.—John W. Wentworth, Minneapolis, Minn.

85,775.—Machine for Making Crucibles.—Joseph Winkle, Pittsburgh, Pa.

85,776.—Door Lock.—Herrmann Ahrend, New York city.

85,777.—Scaffold.—John Anderson, Abel O. Smith, and Isaac C. Wallace, Lakeville, Mich.

85,778.—Water Elevator.—G. M. Atherton, Friendsville, Ill.

85,779.—Governor for Marine and other Engines.—Jearum Atkins, Washington, D. C.

85,780.—Animal Trap.—Samuel Ayres, Worcester, Mass.

85,781.—Vessel for the Formation of Ice.—Benjamin T. Babbitt, New York city.

85,782.—Grain Conveyor.—David L. Bartlett, Rockford, Ill.

85,783.—Baling Press.—J. Berkeley, Washington, Texas.

85,784.—Harness Cock Eye.—S. D. Bingham, Maumee City, Ohio.

85,785.—Sled Brake.—Simeon R. Bolton and Francis Hoyt, Prescott, Wis.

85,786.—Wooden Pavement.—John W. Brocklebank and Charles Trainer, New York city.

85,787.—Universal Globe Joint.—Josiah Bruno, Jr., Lansing, Mich.

85,788.—Toy Blow Gun.—T. Clifford Bush (assignor to himself, Henry P. Ostram, and T. B. Carpenter), New Haven, Conn.

85,789.—Propelling Apparatus.—S. D. Carpenter, Madison, Wis.

85,790.—Composition for Making Self-Cementing Bands.—Elijah M. Carrington, New York city, assignor to Edmund I. Wade, trustee, and said trustee assigns to the Patent Self-Cementing Band Company.

85,791.—Evaporating Apparatus.—Elijah Chitister, Chatham, Iowa.

85,792.—Steam Safety Valve.—Gilbert H. Clemens, New York city.

85,793.—Railroad Car Axle Box.—John C. Creed, Omaha City, Nebraska.

85,794.—Bolt-Fastening for Rail Ties.—Charles H. Crosby, Boston, Mass., assignor to himself, John Ross, and C. A. Trowbridge.

85,795.—Mouth Piece for Smoking Pipes.—J. P. Courtney and William H. Kelagher, Brooklyn, N. Y., assignors to J. P. Courtney.

85,796.—Method of Producing White Pigments from Lead.—John Gallemore Dale and Edward Milner, Warrington, England.

85,797.—Method of Tempering Steel.—Geo. Davis, Elizabethport, N. J.

85,798.—Harness Buckle.—E. S. Dawson, Syracuse, N. Y.

85,799.—Door Knob, etc.—Edwin Day, Chicago, Ill.

85,800.—Veneer Press.—D. Decker, New York city.

85,801.—Grain Separator.—James A. Denton, David W. Shannon, and Elijah Lucas, Winslow, Ind.

85,802.—Centrifrugal Pump.—H. A. Duc, Jr., Charleston, S. C.

85,803.—Combined Safety Attachment and Brake for Carriages.—Claude Ducreux, New York city.

85,804.—Gas Heater.—Laurence A. Duval and Wilfrid G. Duval, Charleston, S. C.

85,805.—Padlock.—Louise Eifller, New York city, administratrix of the estate of Charles Hermann Eifller, deceased.

85,806.—Metallic Roofing.—Levi S. Enos, Chicago, Ill.

85,807.—Lunch Box.—John Erpelding, Chicago, Ill.

85,808.—Hay and Cotton Press.—Elias Evans, Montgomery, Ala.

85,809.—Oven Door.—C. H. Finn, Syracuse, N. Y.

85,810.—Still for Refining and Distilling Oils.—Samuel Gibbons, Binghamton, N. Y., assignor to Excelsior Oil Manufacturing Company.

85,811.—Sectional Bureau.—Elias Gill, New York city.

85,812.—Cultivator.—J. G. B. Gill, Chester Court House, S.C.

85,813.—Burning Kiln.—James Green, St. Louis, Mo.

85,814.—Stone Pavement.—Charles Guidet, New York city.

85,815.—Swivel Mirror Frame.—Christian W. Hafermalz, Providence, R. I.

85,816.—Weighing Scale.—S. S. Hamilton, Taylor's Falls, Minn.

85,817.—Steam Engine Cutt Off.—Thomas Hansbrow, deceased (Lucy A. Hansbrow and B. B. Redding, executors), Sacramento, Cal.

85,818.—Window Blind.—Jones Harding, Galesburg, Ill.

85,819.—Grindstone Journal Box.—James L. Haven, Cincinnati, Ohio.

85,820.—Trace Fastening.—S. C. Hawkins, Patchogue, N.Y.

85,821.—Washing Machine.—Levi Hermance, Hudson, N. Y.

85,822.—Baling Press.—D. H. Hill, Union Springs, Ala.

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85,836.—Extension Table.—G. S. Manning, Danville, Ill.

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85,838.—Gang Plow.—Wm. Mason, Independence, Oregon.

85,839.—Gate Latch.—J. A. Martin, Strasburg, Pa.

85,840.—Horse Hay Fork.—Solomon S. Mattis, Curtin, Pa. Antedated January 2, 1869.

85,841.—Land Roller.—Neal S. McLay, Olathe, Kansas.

85,842.—Curtain Fixture.—Benjamin Moser, Brooklyn, N.Y.

85,843.—Manufacture of Curved Elbows.—Frederick G. Niedringhaus and W. F. Niedringhaus, St. Louis, Mo.

85,844.—Hay Fork Grapple.—John K. O'Niel, Kingston, and J. F. Thomas, Herkimer county, N. Y., assignors to John K. O'Niel.

85,845.—Curtain Fixture.—Patrick O'Thayne (assignor to himself and D. W. Canfield), New York city.

85,846.—Curtain Fixture.—Patrick O'Thayne and David W. Canfield, New York city.

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85,851.—Plow.—Samuel Prentiss and George Flint, De Soto, Mo.

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85,853.—Carriage Top.—Lewis Righter, Salem, Ohio. Antedated January 2, 1869.

85,854.—Seed Planter.—John S. Robb and Samuel P. Allison, Cumberland, W. Va.

85,855.—Composition for the Cure of Hog Cholera.—W. B. Robuck, Oxford, Mass.

85,856.—Tuck Creasing Attachment for Sewing Machines.—Anna P. Rogers, Quincy, Ill.

85,857.—Wringer.—Moses Romans, Fond Du Lac, Wis.

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85,859.—Stave Jointer.—Jas. F. Sayer, Macomb, N. Y.

85,860.—Bleaching Process.—Bruno Schmidt, N. Y. city.

85,861.—Pruning Instrument.—Jeremiah Schroy, Fortville, Ind. Antedated January 2, 1869.

85,862.—Cultivator.—Cyrus Schwanger, Mount Joy township, Pa.

85,863.—Sash-Holder.—W. H. Sible, Harrisburg, Pa.

85,864.—Compound Lever.—John Simpson, Marietta, Ga.

85,865.—Threshing Knife.—Henry Spaulding, Fletcher, Vt.

85,866.—Bed-Bottom.—Otis W. Stanford, Lebanon, Ohio.

85,867.—Blind Fastener.—Simon F. Stanton, Manchester, assignor to himself and J. M. Stanton, Alexandria, N. H.

85,868.—Steam Water Elevator.—C. L. Stevens and Albert A. Denton, Galesburg, Ill.

85,869.—Horse Rake.—Wm. Stinson, Coolspring township, Pa.

85,870.—Harvester Rake.—Ole O. Storle, Norway, Wis.

85,871.—Cement Roofing.—Wm. M. Stuart, and A. J. Chapman, St. Clair, Mich.

85,872.—Horse Rake.—Eli Sweet, Triangle, N. Y., assignor to George T. Guler.

85,873.—Toy Cart.—A. L. Taylor, Springfield, Vt.

85,874.—Toy Bow-Gun.—Howard Tilden, Boston, Mass.

85,875.—Bleaching Ivory, Bone, etc.—D. K. Tuttle, New York city.

85,876.—Hinge Stop.—M. Umstadter, Norfolk, Va.

85,877.—Hydrocarbon-Burner.—Louis Verstraet, Paris, France.

85,878.—Bee-Hive.—Theron Webb, Buda, Ill.

85,879.—Hydrant.—Louis W. Werner, St. Louis, Mo.

85,880.—Clover Harvester.—Jacob Westhafer, Quincy, O.

85,881.—Furnace for Roasting and Calcining Ores.—Ernst Westman, Stockholm, Sweden.

85,882.—Iron Farm Gate.—W. F. Whitney, Milwaukee, Wis.

85,883.—Wood Seat for Chairs.—Geo. C. Winchester, Ashburnham, Mass.

85,884.—Bee-Hive.—John Wood, Alert, Ohio.

85,885.—Bee-Hive.—A. T. Wright, New Vienna, Ohio. Antedated January 5, 1869.

85,886.—Farm Gate.—Geo. Yeomans, Romulus, Mich.

85,887.—Harvester.—G. W. N. Yost, Corry, Pa., assignor to the Corry Machine Company.

85,888.—Tamping Plug.—Hosea Ball, New York city.

85,889.—Treble Attachment for Pianoforte.—A. V. T. Barberie, Brooklyn, E. D., N. Y.

85,890.—Piston Rod Packing.—O. H. Jewell, Chicago, Ill.

85,891.—Machine-Made Stitch.—T. K. Reed, East Bridgewater, Mass.

REISSUES.

80,897.—Safety Bridle.—Dated August 11, 1868; reissue 3,259.—G. W. Barnes, Mount Vernon, N. Y.

81,339.—Self-Cementing Band for Holding Bank Notes, Papers, etc.—Dated August 25, 1868; reissue 3,260.—Elijah M. Carrington, New York city.

59,395.—Hand Stamp.—Dated Nov. 6, 1866; reissue 2,836, dated January 14, 1868; reissue 3,261.—R. B. Hill, Chicopee, Mass.

78,989.—Quilting Frame.—Dated June 16, 1868; reissue 3,262.—Peter H. Mellon, St. Louis, Mo.

74,593.—Valve for Steam-Engines.—Dated Feb. 18, 1868; reissue 3,263.—Jos. Reichmann, Dubuque, Iowa.

43,423.—Churn.—Dated July 5, 1864; reissue 3,264.—Robert Murphy, Jasper, N. Y.

41,788.—Regenerator Furnace for Metallurgists and Others.—Dated March 1, 1864; reissue 3,265.—C. W. Siemens and Fred. Siemens, Westminster, England.

52,120.—Roasting and Smelting Metallic Ores in Vacuo.—Dated January 23, 1866; reissue 3,266. The First National Ore Smelting and Desulphurizing Company, New York city, assignees of John Absterdam.

DESIGNS.

3,334.—Floor-Cloth Pattern.—Hugh Christie, Morrisania, N. Y.

3,335.—Water-Closet Receiver.—Joel Hayden, Jr., Haydensville, Mass.

3,336.—Clock Case.—Geo. R. Holbrook (assignor to Phelps, Dodge, and Company), Ansonia, Conn.

3,337.—Clock Bell Stand.—G. B. Owen, Winsted, Conn.

3,338.—Face Plate of a Sash-Pulley.—Emery Parker (assignor to Russel and Erwin Manufacturing Company), New Britain, Ct.

3,339.—Tea Service.—Wm. Parkin (assignor to Reed and Barton), Taunton, Mass.

3,340.—Butter-Vase or Cooler.—Wm. Parkin (assignor to Reed and Barton), Taunton, Mass.

3,341.—Carpet Pattern.—W. H. Shelmerdine (assignor to Shelmerdine and Aitken), Philadelphia, Pa.

EXTENSIONS.

Dry dock.—J. E. Simpson, of Brooklyn, N. Y.—Letters Patent No. 12,034, dated Dec. 5, 1854.

Circular Knitting Machines.—John Pepper, of Gilford, N. H.—Letters Patent No. 12,046, dated Dec. 5, 1854; reissue No. 1,355, dated Oct. 27, 1863.

Clock Case.—Elias Ingraham, of Hartford, Conn.—Letters Patent No. 129, dated Dec. 3, 1861.

Seats for Public Buildings.—Aaron H. Allen, of Boston, Mass.—Letters Patent No. 12,017, dated Dec. 5, 1854; reissue No. 21, dated Jan. 15, 1861.

Grain and Grass Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated Dec. 5, 1854; reissue No. 875, dated January 3, 1860.

Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated Dec. 5, 1854; reissue No. 876, dated January 3, 1860; reissue No. 2,619, dated May 14, 1867.

Grain and Grass Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated Dec. 5, 1854; reissue No. 877, dated Jan. 3, 1860.

Grain and Grass Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated Dec. 5, 1854; reissue No. 878, dated January 3, 1860.

Grain and Grass Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated Dec. 5, 1854; reissue No. 879, dated January 3, 1860.

Grain and Grass Harvester.—Cyrenus Wheeler, Jr., of Auburn, N. Y.—Letters Patent No. 12,044, dated December 5, 1854; reissue No. 831, dated January 3, 1860.

Throstles for Spinning Cotton.—Charles Danforth, of Paterson, N. J.—Letters Patent No. 12,055, dated December 12, 1854.

Hanging Carriage Bodies.—B. F. Brown, of Dorchester, Mass.—Letters Patent No. 12,051, dated December 12, 1854.

Machines for Scraping Metals.—Jeremiah Stever, of Bristol, Conn.—Letters Patent No. 12,076, dated December 12, 1854.

Processes for Treating the Mother-Water of Salines.—Philippine S. Brackenridge, of Natrona, Pa., administrator of Edward Stieren, deceased.—Letters Patent No. 12,077, dated December 12, 1854.

Rattan Machine.—Sylvanus Sawyer, of Fitchburg, Mass.—Letters Patent 12,073, dated December 12, 1854.

Making Nuts.—Martin P. M. Cassity, of Nemaha county, Kansas, administrator of Isaac H. Steer, deceased.—Letters Patent No. 13,118, dated June 19, 1855; antedated December 19, 1854.

Machine for Splitting Rattans into Strips.—Sylvanus Sawyer, of Fitchburg, Mass.—Letters Patent No. 12,141, dated January 2, 1855.

Machinery for Cutting Rattan, etc.—An act for the relief of Sylvanus Sawyer, of Fitchburg, Mass.—Letters Patent No. 8,178, dated June 24, 1851.

Sawing Machine.—Lysander Wright, of Newark, N. J.—Letters Patent No. 12,176, dated January 2, 1855.

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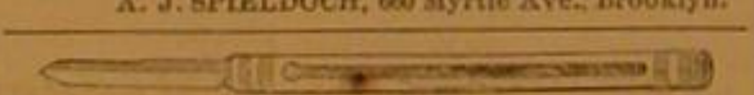

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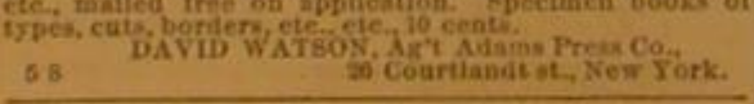

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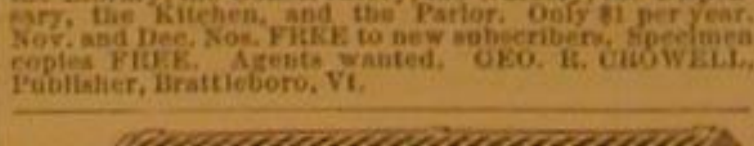

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PATENT MACHINE FOR BORING AND MORTISING BLIND STILES.

The foregoing cut is a representation of a machine for making the mortises for stationary shades, and boring holes for rolling shades in the stiles of window blinds. It is entirely automatic in its operations, and either bores the round hole for the reception of the pivots of turning slats or mortises the recesses for the reception of the ends of those slats designed to be permanently fixed at a certain angle. The latter are made, on this machine, by means similar to those used in boring a simple round hole, the tool being a reciprocatory or traversing burr or bit, which can be used on hard wood, knotty pine, and other obstinate descriptions of wood where ordinary machine chisels fail.

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NOTICE.

TO MANUFACTURERS, RAILROAD COMPANIES, AND ALL WHOM IT MAY CONCERN:—It has come to our notice that J. J. Starr & Co., of Cincinnati, Ohio, E. F. Grant & Co., of Philadelphia, Pa., and another party in Boston, Mass., have issued and served notices, especially a printed notice, entitled "Notice to all whom it may concern," to the purport that all Lubricators, not made by one Gardner Waters, are infringements of a patent granted to one A. C. Dewies, and held by Johnson & Waters, under whom the above-named firms claim title, and that "all parties making, vending, and using Lubricators, not made by said Waters, will be prosecuted to the full extent of the law."

Now we do hereby give public notice to all persons who are now using, or who may use the Dreyfus Patent Automatic Lubricator, that we will, in all cases, at our own expense, protect and defend all persons who may have purchased of us, or of our authorized agents, our said Lubricators. We have taken the advice of able counsel, and are informed the alleged claims could not be sustained against us or persons who are vending or using our Lubricators.

We regard the issuing of the said Circulars as an effort on the part of the above-named firms to injure our trade, and we therefore here give notice to the said J. J. Starr & Co., E. F. Grant & Co., and the said other party, that unless they, and each of them, at once desist from issuing such notices, we shall bring suit against them and deal with them as the law directs for such offences.

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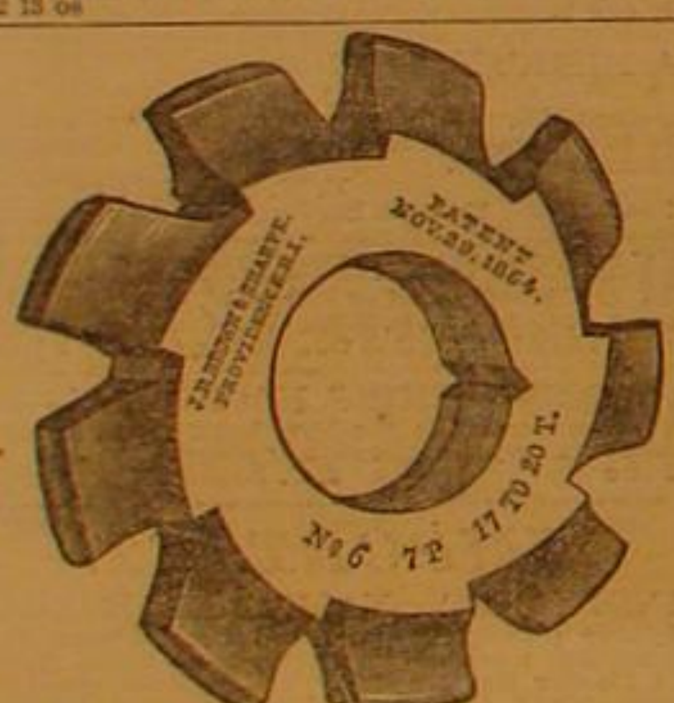

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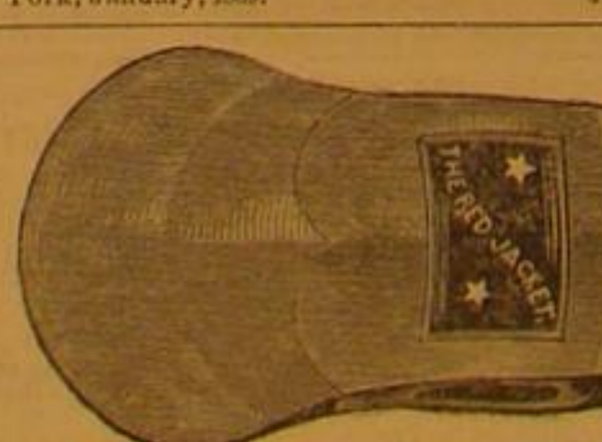

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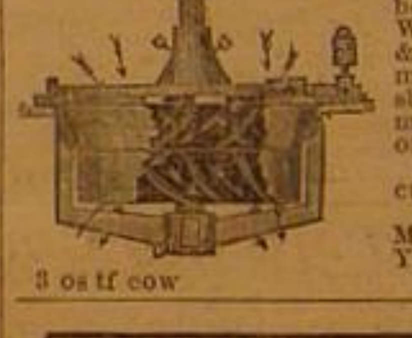

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