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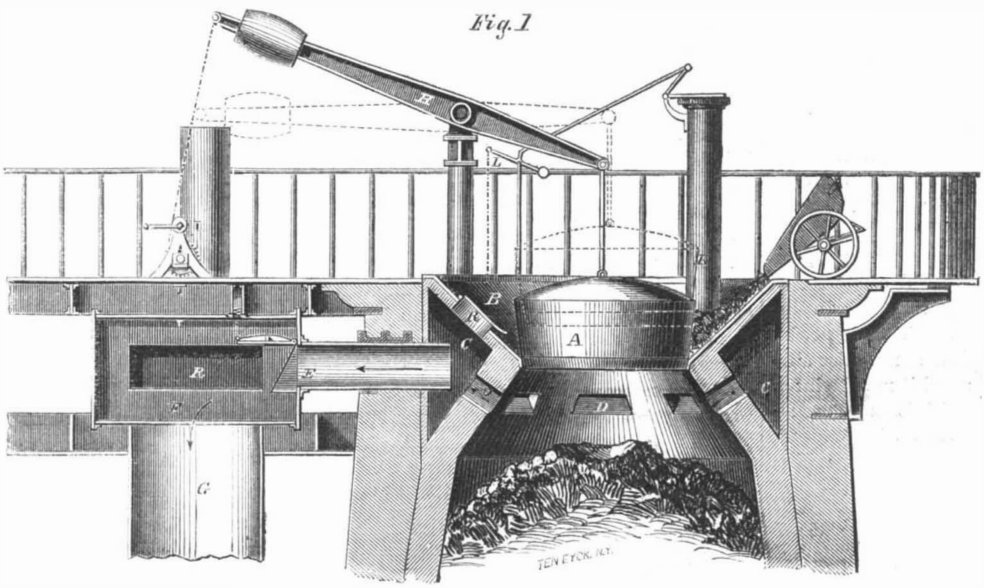
Apparatus for Utilizing the Waste Gases from Blast Furnaces.

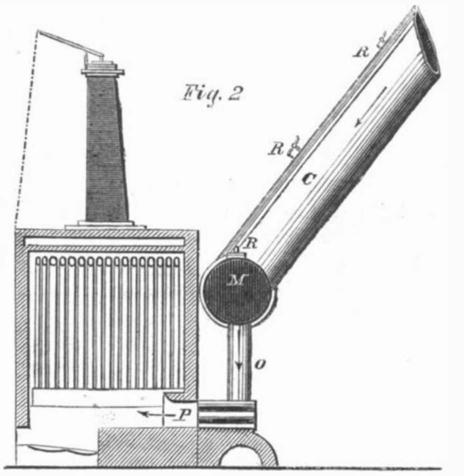
In almost all the arts there is a vast amount of value wasted, and throughout the civilized world a great deal of thought is being expended in efforts to avoid this waste. We presume that in all parts of Europe more attention is directed to these, as well as to all other economics, than in the United States, and there is probably no fairer field among us for profitable invention than this. The following description and illustration of an improved plan for utilizing the waste gases from furnaces we reproduce from the London *Mechanics' Magazine*:—

There is no novelty in the fact of taking off the waste gases from a blast furnace; for many methods have been and are at present employed for accomplishing this object. Though the writer was unaware of any similar method, it is not desired to claim originality in that about to be decribed; but as there is such acknowledged diversity of opinion as to the respective merits of different plans, and great difficulty in procuring reliable information on any, it is proposed to give a description of an arrangement which has been in successful operation for some months at the Ormesby Iron Works, Middlesborough, and bids fair to realise the best expectations of its merits. The large waste of fuel from the mouth of a blast furnace where the escaping gases are allowed to burn away is well known, and amounts to 50 per cent of the fuel burnt; hence there is considerable margin for economy, bearing in mind the large quantity of coals consumed in raising steam for generating the blast, and the further quantity necessary to heat that blast to the required temperature. In fact, assuming a consumption of 300 tuns of coke per week to make 200 tuns of iron, about 100 tuns of coal would be required to generate steam and heat the blast. Taking off the gases from one furnace under such conditions does, according to actual experiment, furnish gas equivalent to upwards of 150 tuns of coal per week. This is obviously an important matter where coals are expensive.

The blast furnace is alternately charged with coke, ironstone and limestone, in proportions depending upon the quality or "number" of iron desired. The arrangement of these materials in the furnace is generally deemed important, though it admits of considerable latitude without any appreciable alteration in the working of the furnace. Thus it does not seem to be of any importance whether the charge of coke be 12 cwts. or 24 cwts., the amount of load of ironstone and limestone being in the same proportion of 1 to 2. The chief point, if there be one, to be gained in the arrangement of the material is to distribute it pretty equally over the furnace, not allowing all the large material to roll outwards and the small to occupy the center of the furnace, or *vice versa:* for it is supposed the ascending gases will pass through the more open material of the furnace to the injury of the closer; thus the two reach the active region of reduction in different states of preparation, and the operations of the furnace are interfered with. To provide for this contingency, which is met in an open-topped furnace by filling at the sides at three, four or even six points of the circumference of the throat, allowing the material to slide inwards two or three feet on a sloping plate, it was considered expedient in the present instance to make the filling aperture as large as practical; it was therefore made six feet six inches diameter, as shown in Fig. 1, so that the material tends to arrange itself in a circle a little outside the center, thus correcting the tendency of large material to roll outward by causing a similar tendency to roll toward the center also. This point is gained in one of the simplest methods in use for closing the top of a blast furnace, where a cone is used to lower into the furnace for filling; but it is secured at the expense of the hight of material in the furnace. A certain hight is necessary for the efficient working of the furnace, and if this be diminished it must be at the expense of fuel in the furnace, since the absorption of heat from the gases depends on the hight of material through which they have to pass up: if this be diminished, the gases issuing from the throat of the furnace will escape at a higher temperature; if increased, at a lower.



APPARATUS FOR UTILIZING THE WASTE GASES FROM BLAST FURNACES.



But there is an important difference to consider in the conditions of a close and an open-topped furnace, to which the writer is not aware that attention has hitherto been drawn; a difference which acts somewhat in favor of the open-topped furnace. The working of the furnaces themselves seems to show that an open-topped furnace is less sensitive to irregularities of moisture in the materiel, quantity of limestone, size of material, &c.; which can be accounted for only by the fact that the open-topped furnace has the advantage of a large amount of surplus heat due to the combustion of the waste gases at its throat, which serves to dispel moisture and calcine the limestone, and helps to warm up the large pieces of ironstone; all of which operations in the close-topped furnace are effected only at a lower point of the furnace, thus necessitating a larger consumption of coke. With the same proportion of ironstone to limestone it has been found to require about 10 per cent more fuel to produce the same number or quality of iron in a close-topped than in an open-topped furnace. In the close-topped furnace the gases pass away at a temperature of about 450° Fah.; whilst in the open-topped a temperature of between 1,000° and 2.000° is generated in the throat of the furnace by their combustion.

In comparing the extra quantity of coke consumed in a close-topped blast furnace with the saving in coals for the boilers and hot blast stoves, it is obvious that the economy to be derived by taking the gases off depends on the comparative value of coke and coal. In the Middlesborough district, where coal is expensive, it is an undoubted source of economy; where coke is very dear, however, and small coal can be obtained at a mere nominal cost for boiler and stove purposes, the use of the waste gases would possibly do little more than compensate for the outlay involved. Here, no doubt, is one source of the variety of opinion entertained in various districts as to the advantage of taking off the gas. The writer's experience at Middlesborough has been that the waste gases can be taken off without affecting the quality of the iron produced, though at the expense of more fuel.

The mode of closing the furnace top and taking off the gas at the writer's works is shown in Fig. 1. The top of the furnace is closed by a light circular wrought iron valve, A, six feet six inches diameter, with sides tapering slightly outward from below, to admit of being easily drawn up through the materials, which are tipped at each charge into the external space, B. To prevent excessive wear upon the body of the valve, shield plates are attached at four points of the circumference, against which the material strikes as it rolls out of the barrows. An annular chamber, C, encircles the throat, triangular in section, into which the gas pours through the eight orifices, D D, from the interior of the furnace, and thence passes along the rectangular tube, E, into the chamber, F. At the extremity of the tube, E, is placed an ordinary flap valve opened by a chain, by means of which the communication between the furnace and the descending gas main, G, may be closed. The valve, A, is partially counterpoised by the balance weight at the other extremity of the lever, H, and is opened by a winch, I, when the space, B, is sufficiently full of materials. At the time when the blast is shut off for tapping the furnace, the gas escapes direct into the atmosphere through the ventilating tube, K, which is connected by levers, L, with the blast inlet valve below.

The waste gases pass from the furnace top to the hot blast stoves to be heated by the waste gases down the descending main, G, Figs. 1 and 2, into the horizontal main, M, Fig. 2, running parallel and close to the line of stove, N, from which descend smaller pipes, O, to each stove. The supply of air for burning the gas in the stoves is admitted through the three tubes, P, and can be regulated at pleasure by the circular slide closing the ends of the tubes, which has an aperture corresponding to each tube, and is planed on the rubbing face, as is also the surface against which it works, in order that the slide may be sufficiently air-tight when closed. The ignition takes place where the air and gas meet, the ignited gas streaming into the stove and diffusing its heat uniformly over the interior. An important element in the working of an apparatus of this description is to provide for explosions, which must take place if a mixture of gas and air in certain proportions is ignited. To provide for this contingency, escape valves, R, are placed at the ends and along the tops of the main tubes, G M; but to prevent explosions as far as possible, the ventilating tube, K, Fig. 1, is used at the top of the furnace, connected with the blast valve at the bottom, so that, when the valve is closed, as at casting time, the act of closing opens the ventilating tube and allows the gas to pass away direct into the atmosphere. The gas would otherwise be in danger of slowly mixing with air passing back through the stoves or otherwise gaining access into the tubes, and would thus give rise to an explosion; until the ventilating tube was provided, it was necessary to lift the valve, A, closing the mouth of the furnace when the blast was taken off, otherwise slight explosions took place from time to time.

In the use of Durham cokes in the blast furnace an inconvenience arises from the large deposit which takes place in the passage of the gas from the furnace and in the stoves and boilers. Under the boilers this deposit is a great objection, as it is a very bad conductor of heat, and needs to be frequently removed; in the stoves it is not so objectionable, though these need a periodical cleansing. The deposit does not arise altogether from the cokes, it is true; and it may be interesting to know its composition, which is as follows:—

Silica	18·86
Carbon	16·14
Alumina	13·87
Sulphate of lime	13·61
Lime	11·01
Protoxyd of zinc	10·31
Peroxyd of iron	9·01
Protoxyd of manganese	2·56
Potash	2·13
Protoxide of iron	1·25
Magnesia	1·25
Chloride of sodium	0·06
	100·00

At a temperature of upwards of 3,000° this mixture melts in a yellowish slag, dispelling the zinc; but there are no signs of fusion at the temperature produced by the ignition of the gas in the stoves, which must roughly approximate to that of melting iron from the results of a few experiments made to ascertain this point; though thin pieces of cast iron were not fairly melted down, they reach the rotten temperature, which is only a few degrees below melting, and gave further signs of nearly melting by throwing off sparks when quickly withdrawn from the stoves and struck smartly against another object. The writer has heard it asserted that the closing of the top of the furnace is the source of mischief to its working by producing a back pressure in it. Under ordinary circumstances, with the furnace top open, the blast enters the tuyeres at a pressure ranging from 2½ to 3 lbs. per square inch. In the present close-topped furnace there are eight outlet orifices, D, Fig. 1, each two feet by one foot, giving a total area of 15 square feet for the passage of between 5,000 and 6,000 cubic feet of gas per minute raised to a temperature of 450° Fah.; and the actual back pressure of the gas, as measured by a water gage inserted into the closed top of furnace, is from ½ to ⅝ inch column of water, or about 1-40th or 1-50th of a pound per square inch, an amount so trivial as compared with a pressure of from 2½ to 3 lbs. as to be unworthy of notice. Of course, if the tubes are contracted in size a greater back pressure will be produced; and it is quite possible that, where attention has not been paid to the circumstance, the back pressure may have interfered with the working of the furnace by preventing the blast entering so freely.

As regards economy in the wear and tear of hot blast stoves of the ordinary construction, there can be no question; the pipes last much longer when heated by gas, provided the temperature of the stove be carefully watched to prevent its rising too high; whilst the value of the same heating surface, compared with its value when coals are used, is greatly increased, owing to the uniform distribution of the ignited gases throughout the stove. In the use of the gases at the writer's works, this economy of surface is such that two stoves heated by gas will do the work of a little more than three heated by coal fires.

The Eureka Lake Ditch.

California is not only one of the most wonderful countries in the world with respect to its natural resources, but also as it regards the enterprizing spirit of its citizens. An amount of original engineering genius, at once comprehensive, bold and wise, has been exhibited in the construction of hydraulic works for conducting water from great distances to the mines, which places her nearly on a level with the heroic old Romans, whose ancient aqueducts still excite our wonder. The following, from the San Francisco *Bulletin*, is an account of one of the California hydraulic enterprizes to which we refer:—

The Eureka Lake Ditch is one of the most remarkable enterprizes in the interior of our State (Nevada county), which, from a very small beginning, has gradually grown into gigantic proportions, and, although before its completion but little known, must be destined to attract a good deal of attention now that it is finished. It traverses the entire extensive region, rich in gold, lying between the Middle and South Yubas, from the summit of the Sierra—where it is fed by a number of larger and smaller lakes—down to the junction of these two rivers, near the French corral, a trunk of 60 miles, but forming, with its branches to all important mining places adjacent, a total of 250 miles of ditch. Throughout this extensive region, the hydraulic method of mining predominates which employs water power as a laboring agent. The call for water is, therefore, enormous, and likely to remain so for a generation, as the mines are very rich, and notwithstanding the numerous claims now worked, yet not more than a commencement may be said to have been made.

The Eureka Lake Ditch Company controls nearly all the water in the district described, and have more of it than their present works can carry; yet they will never be able to satisfy all the present or future demand for it. The whole of this auriferous region is, therefore, entirely dependent on the ditch. For nearly six months the same is supplied by rivers, creeks and some of the lower lakes. During the balance of the year, it receives its water from some large lakes embedded near the summit of the Sierra, among almost eternal snows. The largest of these lakes alone furnishes about 5,000 inches of water daily during four months.

The enterprize was started in 1853, by a company of ten Frenchmen of great intelligence, almost without means, who secured the necessary water rights and had them duly recorded at Nevada. Their tenure of the same found a guarantee in the law which secures to the miner the possession of his claim, and which has been recognized in this State by the Supreme Court. These water rights could at any moment be sold to other ditch companies for a large sum, and are stated to be really worth not far from $1,000,000.

In 1854–5, a small ditch was completed to Eureka South, where the *entrepreneurs* united their interest with those of the Miners' Ditch Company, then already in existence, and in the hands of an intelligent American company and management. A duly incorporated association was then organized, under the name of the "Eureka Lake Water Ditch Company." The Miners' ditch had been in want of water, which the Eureka possessed—the latter lacking, in turn, means to carry on their work as fast as was desirable to the rich mines lower down. In their union, both companies found relief. The sales of water furnished the means for further extension and perfection of the ditch, which, to a great extent, may be said to have been built out of its own resources; and, in its present finished state, is a gigantic enterprize, commanding the greatest admiration.

The entire works—ditches, flumes, aqueducts, pipes, reservoirs, &c.—are stated to have cost about $950,000, toward which the work itself has paid about $750,000. Since April last, the weekly cash receipts have averaged, we are informed, about $6,000. The annual income is at present $300,000, for water is sold in winter also. The monthly expenses of the company for preserving the whole property in the best of condition amount to about $3,000, including the administration. The amount of water sold daily is about 6,000 inches, at 16 cents, while, we are informed, most companies in California charge from 25 to 50 cents per inch. The company is just now occupied in enlarging the main (trunk) ditch, and making some other important improvements which will increase the amount of water they can deliver. By going to further expenses, in increasing the capacity of some of the ditches, flumes and dams, the weekly receipts could easily be raised to $10,000, without exceeding $50,000 extra outlay.

There are about 40 reservoirs, which cost from $3,000 to $6,000 each. The iron pipes, 22 inches in diameter, which carry the water through San Juan, from one hill to another, cost $12,000. An aqueduct, named the "Magenta Flume," between Bloomfield and Eureka, was built at a considerable expense, and is as substantial as it is beautiful—a work of art, and a wonder to behold.

The above information we owe to parties intimately acquainted with the enterprize, which illustrates how much may be accomplished with scanty means and energy in a country like California. The small number who originated and accomplished this stupendous work form still its principal shareholders. They have for years seen no return for their labor, and have at times been compelled to pay crushing rates of interest; still, they have mostly preserved their shares, and are about to reap a rich harvest.

Connected with the enterprize, and also belonging to the company, is a tailing flume of about four miles in length, commencing near Bloomfield, and following from there the bed of Humbug creek down to the South Yuba. This flume will cost about $25,000, and receives all the tailing of that rich outlet. The adjacent mines are supplied by the company with water—the latter once more returning to the company's possession and use through this flume, without cost. It is mostly finished, and will undoubtedly pay handsomely.

New Zealand Steel.

Ever since the settlement of New Zealand by Europeans, their attention has been daily called to the peculiarities of a kind of metallic sand along the shores of New Plymouth, in Taranaki. This sand has the appearance of fine steel filings, and if a magnet be dropped upon it and taken up again, the instrument will be found thickly coated with the iron granules. The Australian *Mail* gives a lengthy account of it. It states that the place where the sand abounds is along the base of Mount Egmont, an extinct volcano, and the deposit extends several miles along the coast, to the depth of many feet, and having a corresponding breadth. The geological supposition is that this granulated metal has been thrown out of the volcano, along the base of which it rests, into the sea, and there pulverized. The quantity is so large that people out there looked upon it as utterly valueless. Captain Morshead, a gentleman in the West of England, was so much impressed with its value that he went to New Zealand to verify the reports made to him, and was fortunate enough to find them all correct. He smelted the ore first in a crucible, and subsequently in a furnace; the results were so satisfactory that he immediately obtained the necessary grant of the sand from the government, and returned to England with several tuns for more conclusive experiments. It has been carefully analyzed in that country by several well known metallurgists, and has been pronounced to be the purest ore at present known; it contains 88.45 of peroxyd of iron, 11.43 of oxyd of titanium, with silica, and only 12 of waste, in 100 parts. Taking the sand as it lies on the beach and smelting it, the produce is 61 per cent of iron of the very finest quality. And, again, if this sand be subjected to the cementation process, the result is a tough, first-class steel, which, in its properties, seems to surpass any other description of that metal at present known. The investigations of metallurgical science have found that if titanium is mixed with iron, the character of the steel is materially improved; but, titanium being a scarce ore, such a mixture is too expensive for ordinary purposes. Here, however, nature has stepped in, and made free gift of both metals on the largest scale. To give some idea of the fineness of this beautiful sand, it will be enough to say that it passes readily through a gauze sieve of 4,900 holes or interstices to the square inch. As soon as it was turned into steel by Mr. Mushet, of Coleford, Messrs. Moseley, the eminent cutlers and toolmakers of New-street, Covent Garden, were requested to see what could be done with the Taranaki steel. They have tested it in every possible way, and have tried its temper to the utmost, and they say the manner in which the metal has passed through their trials goes far beyond anything that they ever worked in steel before. Messrs. Moseley, in whose hands the sole manufacture of cutlery and edge tools is vested for England, have placed a case filled with the metal in all its stages in the Polytechnic Institution. There is the fine metallic sand, some beautiful specimens of the cutlery made from it, and the intermediate phases of the iron and steel. An official experiment is expected to be made at some of the government establishments shortly, and it is also intended to forge some chain cables, anchors, &c., in order to fully set forth the great superiority of the Taranaki iron.

Cookery.

The following, from the London *Review*, is of very general application:—"Two things are necessary to be taught the ignorant—the value of several articles of food now left to waste by the wayside, and how to cook. The English are notoriously the worst and most wasteful cooks in the world, and among the most prejudiced feeders. Fine wheaten bread—not half so nutritious, by the by, as that which has the bran left in —tea in unknown quantities ; the best meat, or none at all ; a celebrated fish or two—with a score of prejudices against the cheap, the unknown or the unusual —constitute the English idea of table comfort. As to any makeshift, any savory preparation out of unpromising material, not one in a thousand entertains such an idea. Unusual food is not considered respectable in England. Yet thousands of hundredweights of good food yearly decay because of the silly fancies of ignorant people. Rich, wholesome, appetizing fungi poison the air when they might have fed the hungry or added grace and flavor to the scanty meal ; wet, poor lands lie laden with their harvest of thistle and burdock, when they might have grown oats or other hardy crops good for man and beast. Scrofula and scurvey break out for want of 'greenment,' when nettles and dandelions, and heaps of hedgerow vegetables and salads, wait the picking ; and odds and ends of beasts reckoned 'coarse' get put to unprofitable uses, while their legitimate function of feeding the folk is neglected as unworthy and degrading. In Ireland, during the famine, thousands of pounds of ox liver were made into snuff, while men and women were dying of hunger, and emptying out on the road sacks of maize meal, rather than live by a food which they said was 'fit only for the hogs.'"

The Lowest Type of Humanity.

We take the following extract from the article on "Barbarism and Civilization," in the *Atlantic Monthly :*

In the interior of the island of Borneo there has been found a certain race of wild creatures, of which kindred varieties have been discovered in the Phillippine Islands, in Terra del Fuego, and in Southern Africa. They walk usually almost erect upon two legs, and in that attitude measure about four feet in hight ; they are dark, wrinkled and hairy ; they construct no habitations, form no families, scarcely associate together, sleep in trees or in caves, feed on snakes and vermin, on ants' eggs, on mice, and on each other ; they cannot be tamed, nor forced to any labor ; and they are hunted and shot among the trees, like the great gorillas, of which they are a stunted copy. When they are captured alive, one finds, with surprise, that their uncouth jabbering sounds like articulate language ; they turn up a human face to gaze upon their captor ; the females show instincts of modesty ; and, in fine, these wretched beings are men.

Application for the Extension of a Patent.

Cast Iron Wheels for Railroad Carriages.—Anson Atwood, of Troy, N. Y., has applied for the extension of a patent granted to him on the 15th of May 1847, for an improvement in the above-named class of inventions. The testimony will close on the 8th of April, next ; and the petition will be heard at the Patent Office on the 22d of same month.

In the great earthquake which overthrew the town of Riobamba, in 1797, the ground was raised with such violence that the bodies of several of the inhabitants were hurled to Cullca, a hill several hundred feet in hight, and on the opposite side of the river Lican.

MISAPPREHENSIONS AMONG INVENTORS—PATENTS NORTH AND SOUTH—SUGGESTIONS TO MECHANICS.

We are led to believe, from the number of letters we are constantly receiving, similar in purport, that an impression is prevalent in the community, that the rights of patentees will not be respected should a dissolution of the Union take place.

One inventor hesitates to apply for a patent until our political difficulties are settled ; because, should the Southern States secede from the Northern and middle States, his rights would not be respected in but about half the States, and thus his patent would be worth only half price, seeming to forget that the demand for snow-plows has never been very great in the Southern States. Another inventor writes that his model is ready to forward, and he is anxious to have his rights secured, but he thinks he will wait until after the 4th of March. What advantage the writer expects to gain by the delay, he omits to explain, and we fail to conceive. Another correspondent is afraid to have his model deposited in the Patent-Office lest the Southern Confederacy may seize upon Washington City ; and, when they convert the Patent-Office edifice to some other purposes from which it is now used, he is afraid his model will be destroyed.

Now, all these troubles which haunt the mind of inventors are imaginary, so far as securing their patents or protecting them is concerned. It is the manufacturing and mechanical States of the North which have ever been the great patrons of the patentee, and while we do not apprehend any permanent division of the union of States, and interests between the North and South, even should an event so deplorable to all sections occur, we see no reason why patent property should be materially depreciated: certainly not in a greater ratio than merchandise, stocks, or even real estate, in cities and manufacturing towns.

The South are a cotton raising and agricultural people, having given heretofore but little attention to manufacturing and mechanical pursuits, while the industry of the Eastern, Northern and Middle States is in a great measure devoted to manufacturing and mechanical business; the Western comprising both mechanics and agriculture to an extent which is known to most of our readers. So far as the South have required inventions they have patronized them as liberally perhaps as any other section of the country, but it has not been within the nature of their wants to require patented improvements to the extent of other sections.

We have intended by these remarks, to show that under any circumstances inventors residing within the Federal States, whatever forebodings they may have relative to the political questions of the day, may have none in regard to the protection of their rights in in all States within the jurisdiction of the federal laws, and that those States which will abide by the Union at all hazards (and we trust such a compromise may be made that all will) are comparatively the only patrons of the inventor and patentee. Instead of hesitating to apply for patents on any of the grounds we have hinted at, we think inventors who are prepared to secure their inventions will not find a better opportunity than the present. The Patent Office is not so over-crowded with applications as usual, hence cases are more speedily acted upon. To those who have not their inventions matured and models completed, but have experienced or seen some defect in machinery, which they think they can obviate, it is their duty, and will probably be to their pecuniary profit, to study over, mature, improve and construct, some plan to obviate the difficulty, during the long evenings of these winter months.

Exploit in Diving.—In raising the treasure of the steamer *Malabar*, which was wrecked last summer on the coast of Ceylon, the divers worked under water through nine feet of sand, and then cut away large iron plates half an inch thick, forming the sides of the mail room of the steamer. Eighty thousand dollars worth of treasure were thus obtained in one day. The steamer had over $1,500,000 in gold on board, all of which has been saved.

Progress of Secession.—The Convention of the State of Florida assembled at Tallahassee, passed an ordinance of secession on the 11th inst. Mississippi, in convention on the 9th, declared herself out of the Union ; and Alabama will, in all probability, have voted herself out before we go to press.

THE SCIENCE OF COMMON THINGS.

Number IV.

BEEFSTEAKS.

"The two parts of beefsteak—the fat and the lean—furnish very good samples of the two great classes into which organic substances naturally divide themselves, those which contain nitrogen and those which do not—nitrogenized and non-nitrogenized substances. The fat, or adipose matter, is composed of hydrogen, carbon and oxygen, while the lean part, or muscle, besides these three, contains also a large proportion of nitrogen."

"Do you say that the lean part of the steak is muscle?"

"Yes."

"I thought the muscles were a sort of cords."

"They are cords of red flesh."

"But this looks like a mere lump of meat."

"That is because it is cut across. If it were dissected out lengthwise, you would see that it was a cord or band of lean meat, terminating in tough gristle at each end, one end fastened to one bone and the other to another bone, so that when the muscle is contracted or shortened it would move one of the bones. This is the purpose of most of the muscles—to move the limbs. For instance, here is a muscle in the arm, between the shoulder and the elbow; the upper end is fastened to the bone near the shoulder while the lower end terminates in a smooth, strong tendon, which passes under a band at the elbow, and is fastened to one of the bones of the forearm. From this arrangement it follows that, if the muscle is shortened, the hand is drawn up, bending the arm at the elbow joint. If you grasp your arm half way between the elbow and the shoulder, and bend your elbow, you will feel the muscle thicken up in the middle as it contracts."

"What makes the muscle contract?"

"There are little white, tender cords, called nerves, which lead from the brain, or from the spinal marrow which connects with the brain, to every muscle in the body, and when the will desires the limb to move, the impulse is carried in some mysterious way by the nerve from the brain to the muscle, impelling the muscle to contract and move the limb."

"How is it known that the impulse is carried by the nerve?"

"By a long series of investigations. For instance, if the nerve is cut off, the muscle to which it leads ceases to obey the will any longer; it becomes paralyzed."

"What! do they cut off people's nerves to find that out?"

"No; but they cut off the nerves of dogs, rabbits, &c. Dr. Dalton, in his lectures at the medical school up town, slaughters dozens of dogs every season to illustrate various facts in physiology, cutting the poor animals up alive in every conceivable manner."

"That seems cruel."

"Yes. Man, in his pursuit of knowledge, tramples on all feelings. He braves the cold of the polar regions and the heat of the tropics; he endures hunger, thirst, sickness and long and patient labor. The human intellect, in its march, is endowed with tremendous strength."

"The messages from the brain must be carried pretty quickly along the nerves."

"Yes; but they occupy an appreciable time, however. Astronomers learn this in their delicate observations. As the earth turns on its axis from west to east, it causes the stars apparently to sweep over the sky in the opposite direction, from east to west, as the sun and moon do. As they pass before the telescope, the astronomical observer watches their passage, and as the particular star which he desires to observe comes in line with the fine spider's web drawn across the middle of the telescope, he marks the time with his finger on a very delicate and accurate astronomical clock. Now, it is found that, after the will gives the command to the finger to act, it takes a certain time for the nerve to convey the command to the muscle and for the muscle to operate; and this time varies with different men, some men's nerves acting more rapidly than others. The first step of an astronomical observer is to find out how much time it takes for his own muscles to act; ascertaining the personal equation, as they call it. I have heard Professor Mitchell state what his personal equation is, but I have forgotten; a very small fraction of a second, however."

"You say the office of most of the muscles is to move the limbs or bones, what do the others do?"

"There is one muscle round the mouth to close it. There are delicate little muscles that move the eyelids, and the heart is a muscle, or set of muscles, which, by their contractions, drive the blood through the arteries, all over the system."

"What is the use of fat?"

"It performs several offices. One is to round out the system and complete the beauty of the person. Your cousin Jane's smooth neck owes its beauty to the skillful manner in which the adipose matter is packed into all the crevices between the muscles, veins and arteries. For Nature expends no small amount of labor in the production of beauty. 'Behold the lilies of the field, not Solomon in all his glory was arrayed like one of these.' Another use of the adipose matter is to serve as a reservoir of aliment for the support of the system. In the fever which I recently had, my stomach was in such a state that it could digest no food, and, by one of those beautiful adjustments so common in nature, my appetite rejected it, and I did not eat a mouthful for several days. The consequence was that the heat of the body had to be kept up by burning the fat in the system, and how rapidly this was consumed! I suppose I lost 20 pounds in the course of three days. Hibernating animals, that sleep through the winter, are generally as fat as they can be when they crawl into their nests in the Fall. Their thick furs prevent the radiation of heat, so that little is required to be generated; their breathing and circulation are sluggish, causing a slow consumption of matter, and this matter is supplied by the store of fat in the system, which is slowly burned up during the winter, and the animals come out in the Spring as lank as Pharaoh's lean kine. If you put a piece of fat on the fire, you see that it burns with a blaze. Whenever any organic substance burns with a blaze you may be almost sure that it contains hydrogen. The burning of a substance is simply its combination with oxygen. Whenever an organic substance containing hydrogen is sufficiently heated, it is decomposed, and, as the hydrogen is separated from the other elements, it takes the gaseous form. Rising in this hot state, as it comes in contact with the oxygen of the air, it combines with it, in other words, burns; one atom of oxygen combining with one atom of hydrogen, and producing water (HO). There is phosphorus in the bones which, when separated, will burn with a flame, but almost invariably when you see any animal or vegetable substance burning with a blaze—the flame of a lamp, of a kitchen fire, of a burning building—it is hydrogen in the act of combining with oxygen, producing water. On the other hand, when you see any organic substance burning with a red heat, without blaze, like charcoal or anthracite coal, it is carbon combining with oxygen and producing, generally, carbonic acid. If the blaze produces a good deal of light, you may be pretty sure that the substance contains both carbon and hydrogen; the light coming principally from the intensely heated carbon before it is burned."

The Watch of General Washington.—We were shown yesterday, says the Louisville *Journal*, a gold watch of the olden time, which is of great value as a memento of an important event in American history. The watch was a present from Gen. Washington to Gen. Lafayette, and bears the following inscription on the back of the inner case: "G. Washington to Gilbert Mattiers de Lafayette. Lord Cornwallis's capitulation, Yorktown, December 17, 1781." The watch is of London manufacture, and was made in 1769. It is said that the watch was taken to San Francisco from Paris by a Frenchman, who became embarrassed there, and sold it to the present owner for the sum of fifty dollars.

Considerable interest has been manifested in New York in regard to an invoice of Peruvian cotton recently received *via* Panama. We understand that it is part of a shipment of fifteen hundred bales, most of which was consigned to Europe. The quality is very beautiful, and the sample shown would sell readily at fifteen cents, even in the present state of the market. The plant from which it is taken is said to be a perennial shrub in Peru, indigenous to the soil, the growth of which already extends over a considerable tract of country, and needing only a little labor in the way of cultivation to yield large returns.

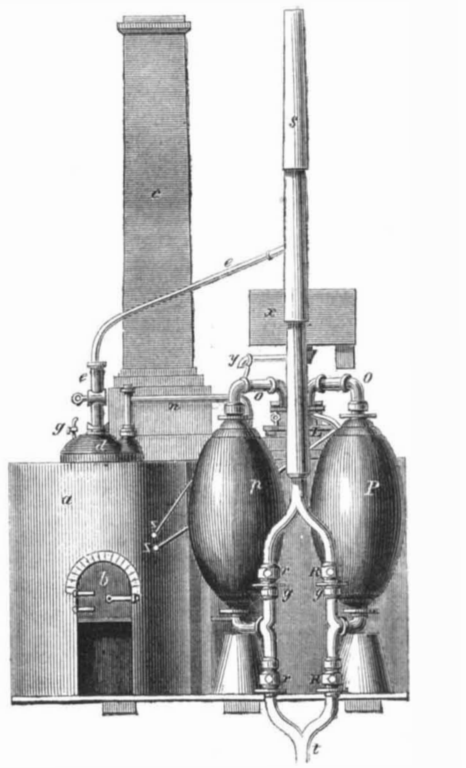
ROMANCE OF THE STEAM ENGINE.

Article VII.

SAVERY—CONTINUED.

In the early part of the seventeenth century, England had acquired a high position in metallurgy. This was due to her coal resources, as it was even then well known that there was more coal beneath the surface of that island than there was in France, Germany and Sweden. Her iron manufacturers, however, came to a stand still about 1700, owing to the great expense of working her deep coal mines, which really contained the best and greatest amount of this fuel. Horse-power was then generally used for pumping up the water and raising the coals. This answered very well for shallow mines, but as these were worked out, the value of coal lands began to deteriorate, owing to the difficulty of boring and working the deep mines. At this period the whole country was incited to look for some new invention that would work these mines. This is the reason why the early steam inventors in England devoted special attention to the application of their engines for pumping water from the deep pits, and Captain Savery was among the most ingenious of these early steam engineers.

The accompanying figure represents the direct steam engine of Captain Savery, of which he said, in a pamphlet called "The Miner's Friend" (published in London in 1702): "Its power is in a manner infinite and unlimited, and will draw you water five hundred or a thousand feet high, were any pit so deep. . . . I dare undertake that this engine will raise you as much water for eightpence as will cost you a shilling to raise the like with your old engine, the which is thirty-three pounds, six shillings and eightpence saved out of every hundred pounds; a brave estate gained in one year out of such great works, where as much as eight thousand pounds are expended per annum for clearing mines of water only, besides the expense for repairs of gins, engines, and for horses, &c." Thus, Savery calculated the advantages of his engine, and he said that, for one hundred years previous to his invention, no improvement had been adopted in working



the English mines. This engine has two boiler fires, *a*; one boiler, L, is larger than the other; *b* is the furnace of one, and *c* is the general chimney. The small pipe, *g*, reaches nearly to the bottom of the boiler. The other pipe, *n*, of greater size, is inserted into the same depth, and has a clack valve in it above the boiler top, opening upwards; this pipe, *n*, passes into the large boiler; *o o* are steam pipes; one end of each is inserted into the root of the large boiler, L, and the other end of each into one of the receivers, *o* P. In this manner communication is formed between each of those vessels and the boilers; *q q* are screws by which water pipes are fastened together. R R *r r* are valve boxes in the pipes; *s* is a pipe through which water is forced from the receiver, and is conveyed into an elevated cistern; *t* is a pipe running down into the mine from which the water is to be raised; *x* is a cistern connected with the pipe, *s*; the pipe, *y*, is mounted in a swivel water-tight joint, and it can be turned round upon each of the receivers, P *p*, to make water flow over them to condense the steam inside; *z z* are handles of the regulators.

The boilers, we will suppose, are filled with water to the necessary hight; all the cocks are shut; the valves are in position, and the receivers empty. A fire is now first placed under the larger boiler, and steam is raised to such a pressure as will balance a column of water equal to the hight between the bottom of the vessels, P *p*, and the upper surface of the cistern to which the water is to be raised through pipe, *s*. By turning the handle, *x*, of one regulator, it opens a communication between the vessel, *p*, and the boiler; all the air is then expelled through the valve, *r*, into pipe, *s*. The handle of the regulator is now turned, and the steam from the boiler is cut off when the vessel, *p*, is full of steam. Water is now made to flow over its surface by pipe, *y*, from the cistern, *x*. This condenses the steam, forming a vacuum inside, when the water from the mine immediately rises through pipe, *t*, into the receiver and fills it. The valves, *r*, are now closed so that no water can ascend from the mine, and then steam is admitted by the regulator into the top of the receiver, *p*, again, when the water is forced upwards through *p s* into the elevated cistern. The same operations take place with the other vessel, P, and so on continually, thus raising a steady column of water by the alternate actions of steam and condensation in the two vessels, P *p*.

In order that the large boiler should be kept continually working, Savery used the small boiler, *d*, to feed the large one through pipe, *n*. The small boiler was kept closed, and when its pressure exceeded that of the large boiler the water of the former was forced into the latter by the pipe, *n*, to replenish it at intervals. The small boiler was fed at intervals with cold water through pipe, *e*, which received it from the discharging water pipe, *s*. This was certainly a most ingenious and direct boiler feeder. The cistern, *x*, which furnished water for condensation, was also supplied with water from pipe, *s*. All the clack valves in the pipes opened upwards.

Such is a description of the construction, arrangement and operation of Savery's celebrated engine, called a fire engine; and it was certainly more entitled to the name of caloric engine than any hot air motor of more modern times. Such an engine is of course out of the question at the present day, but it affords us evidence that he possessed an inventive mind of a very high order. He stated that it would be very useful for pumping water into an elevated reservoir, from which it could be taken to drive a water wheel—a mode of driving machinery by water power which has been proposed to us several times within a very few years. Savery obtained a patent for his engine in 1698, at which period he had really erected several of them, and they had operated very successfully in comparison with that of the Marquis of Worcester and others that had preceded them.

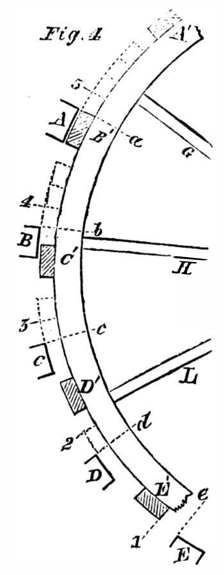
A very curious incident is related regarding the way Savery's mind was first directed to steam engineering, and it shows that, in one instance at least a tobacco pipe afforded a lesson of inspiration. Switzer says: "This gentleman's thoughts (Savery's) were always employed in hydrostatics or hydraulics, or in the improvement of water works; and the first hint which, it is said, he took his engine from was a tobacco pipe, which he immersed in water for the purpose of washing it. He discovered, by the rarification of the air in the hot pipe, that the water was made to spring through its tube in a wonderful manner."

Separation of Bismuth from Lead.—The *Annales des Mines* states that, in some of the mines of Germany, the ore of lead contains a small quantity of bismuth, which concentrates in the pig lead. Towards the end of the cupellation there forms a green litharge, very rich in bismuth. This is gathered separately, reduced, and the alloy of lead and bismuth is cupelled. There remains some bismuth, which is placed in another furnace and heated until it sparkles (*ce que le phénomène de l'eclair ait lieu*). In an essay on a large scale, 50 quintals of green litharge were reduced. The alloy contained 54.5 of bismuth and 65.5 of lead. The bismuth extracted contained only traces of lead and of iron, and 0.42 per cent of silver.

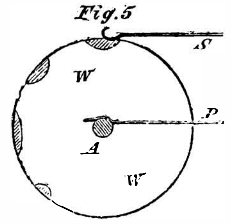
ELECTRICITY AND SOME OF ITS PRACTICAL APPLICATIONS.

ARTICLE IV.

The electro-magnetic rotary engine is constructed in an entirely different manner. It consists of a wheel, on the circumference of which are bolted two or more armatures. Outside of this, and placed in the direction of a radius, is an electro-magnet, which is so arranged that, by means of a contact breaker, it shall attract the armature nearest it until it comes directly opposite, when the current ceases to flow; the whole revolves by the momentum it has acquired until another armature approaches the magnet, when the current again commences to flow, and the second armature is attracted; and this alternate attraction and cessation of attraction produces a rapid rotary motion. As the armatures must necessarily be at some distance from each other, it is evident that if any sudden resistance should occur while the magnet was at a distance from any of the armatures, the machine must necessarily stop. To avoid this difficulty, it was proposed to employ a number of magnets, which should operate successively one after the other, and thus bring a continuous power to bear upon the wheel. The cut Fig. 4 represents a sectional fragment of such a device. A B C D E are electro-magnets, and A' B' C' D' E' the armatures which they are to successively attract, bolted firmly upon the circumference of the wheel, G H L. The magnet, E, is fixed at a certain distance from E', which distance should be that through which it operates to the best advantage. D is at a distance twice as great from its armature, and C three times as far from C'; and so on. Now, suppose E to become magnetic; it will attract E' until it reaches *e*; the current is now to be transferred to D, which will attract D', from 2 to *d*; meanwhile, the wheel will have revolved sufficiently to bring C' to 3, when the current being transferred to *c*, it will be moved from 3 to *c*. This operation being kept up, A' will finally reach the point, *a*, and, if the parts are properly proportioned and adjusted, D', will have reached the point, 1, while E' will have passed sufficiently far beyond E to be out of the reach of its attraction. The current being now passed through E, and then successively through the entire series, again the revolution will be kept up, and will proceed with rapidity.



It will be seen that, in the above engine, although a number of electro-magnets are used, yet a current having power sufficient for only one will suffice for the whole. By increasing the number of magnets, the distance through which they attract their armatures may be diminished, and power gained thereby. For breaking the contact of the conducting wire, *i. e.*, for interrupting the current, a device called the "contact breaker is employed. There are several forms of this instrument, one of the best of which is represented in the cut. W W is a thick disk of metal, which is usually attached to the main shaft of the machine which it is to regulate. Upon the shaft of the disk a spring, P, presses; this spring is connected with one electrode of the battery, and another spring, S, presses upon the circumference of the disk, and is connected with the other pole of the battery. If these springs remain in contact with the disk, which is a good conductor, the current will pass without interruption, whether the disk rotates or remains stationary; but whenever a stoppage of the current is desired, a portion of the disk can be removed by filing or otherwise, and the cavity filled with a non-conductor, as ivory. In the cut, the dark portions represent the non-conducting portion of the disk. It will be seen that these portions can be extended at pleasure.



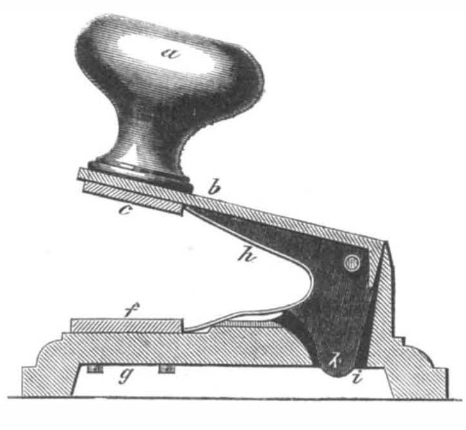
There is an application of electro-magnetism which, although it does not come directly under the head of magnetic motors, yet is a case of motion produced by electro-magnetism. In many machines, there are parts remote from the point at which the power is applied, which require eccentric motions, and these motions must be given through the agency of an endless succession of screws, cams, rackwork and other contrivances, the construction of which often displays much ingenuity, but, at the same time, such contrivances involve a great expenditure in their construction, and much power is consumed by the friction which they occasion. Many such motions—we do not say all—might be given by means of electro-magnets properly arranged. When a rotary motion is desired, an arrangement similar to a small magnetic engine may be made use of. The frequency of such motions can be easily controlled by means of the contact breaker.

There are often situations where a motion either reciprocating or rotary is required, and where, at the same time, it is difficult to give such motions by mechanical means—sometimes on account of the inaccessibility of the part to be moved, and in some cases because of the great friction or liability to corrosion or breakage of the part by which such motions are transmitted. The opening and shutting of ventilators, flue valves, and other appliances used in connection with the warming of large halls and other public buildings, is often attended with difficulty, for the reason given above; but such motions could easily be effected by means of the various devices previously described. We might go on multiplying such instances, but any one who will turn his attention to the subject will find no lack of opportunity for making applications of this kind.

In estimating the expense of working any such arrangement which is to be in use only for a short time, it should be borne in mind that there is no consumption of zinc and acid in the battery except while it is in operation; and if it is only used for short periods, the cost will be trifling.

TEISSERE'S BLANK STAMPING PRESS.

This invention of Mr. A. Teissere, of No. 29 Boulevard St. Martin, Paris, consists of an improved dry stamping press, which may be substituted for presses hitherto in use for that purpose, and also presents the advantage of being easily handled, very simple, and may be produced at a cheaper rate. This press is formed of two parts; of an upper movable piece turning on an axis carrying the impressed letters, figures, or ornament to be stamped, and of a lower piece carrying the letters or corresponding figures or ornament in relief.



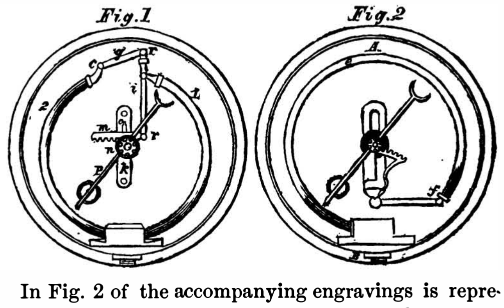
The engraving represents a central vertical section of a press; *a*, wooden knob to receive a firm pressure to press the upper part, *e*, on the part, *f*; *b*, upper part turning on an axis, *d*, which carries the plate, *e*, on which are the sunken letters; *c*, lower fixed part carrying the plate, *f*, on which are formed the letters in relief; *d*, holes formed in the fixed and movable parts to receive the axis on which the upper part, *b*, moves; *e*, plate with the sunken letters fixed to the piece, *b*, with the aid of a screw; this plate can be removed at will; *f*, plate with the letters in relief fixed to the piece, *c*, with the aid of screws, *g g*, which can be removed at will; *g g*, screws intended to fix the plate *f* to piece, *c*; *h*, spring intended to support the movable part, *b*, at a certain hight above the fixed part while the press is not in use; *i*, hollow made in the lower part intended for the passage of the projection, *k*, at bottom of upper part, *b k*, projection for preventing the upper part, *b*, rising too high.

The parts being thus arranged the press works as follows:—Between the two plates *e* and *f* is placed the sheet of paper to be stamped, and the operator gives with the hand a sudden pressure on the knob, *a*, thi sudden pressure causes the movable part, *e*, to approach with force against the fixed part, *f*, and in this way the paper pressed between the two plates receives the impress. So soon as the pressure of the hand ceases to act on the button or knob, *a*, the upper part, *b*, rises by the action of spring, *h*, and thus the sheet of paper is easily removed, bearing the impression. This press was patented February 20, 1860.

NEWTON'S IMPROVEMENT IN PRESSURE GAGES

[From the London Engineer.]

This is an invention that relates to certain improvements in the construction of the Bourdon pressure gage, the object being to remedy certain defects which have detracted from its merit under certain circumstances. Thus, for example, water accumulated in the tube has, on exposure to a low temperature, frozen and burst the gage; again, when applied to locomotive engines, they receive a tremulous motion, and give uncertain indications through the tremulous movement of the index hand.



In Fig. 2 of the accompanying engravings is represented a gage of this description of the usual construction, the bent tube, A, being attached at one extremity to the pipe, B, through which the pressure within the boiler is transmitted to the interior of the tube. When thus constructed, if the bent tube exceeds a semicircle in length, a portion of the tube (as from *e* to *f*, Fig. 2,) hangs down below the point, *e*, so as to form a receptacle in which water soon accumulates from the condensation of vapor within it. The water thus collected is liable to freeze in winter, by which the indicating tube is often burst or strained. To remedy this difficulty it is necessary so to combine the bent tube with the pipe that any water that may condense within the tube shall drain back into the pipe; but it is manifest that a tube attached to its pipe, as represented in Fig. 2, will not thus drain itself in any position in which it can be placed. To accomplish this end is the object of the first part of this invention, which consists in so combining the indicating tube with the pipe through which the pressure within the boiler is transmitted to the gage, that the length of tube in any direction from its junction with the pipe shall not exceed a semicircle, and in placing the tube in such a position that it shall descend at every point towards its junction with and drain back into the pipe. When used upon locomotives, the gage represented in Fig. 2 is liable to another serious objection, arising from the violent shocks and jarring to which the engine is subjected as it passes over the road. These shocks are of a two-fold character, first, those which are occasioned by obstacles encountered by the tread of the wheels (as the joints of rails, &c.), and which occur in directions nearly vertical; second, those which are occasioned by the swaying of the engine from side to side, and by the striking of the flanges or fillets of the wheels against the sides of the rails, and which occur in horizontal directions. The first class of these disturbances communicate to the bent tube, when arranged as in Fig. 2, a tremulous motion in a vertical direction, while the horizontal shocks to which the engine is exposed cause the tube to vibrate in directions nearly horizontal. These vibrations of the indicating tube impart a frivolous vibratory motion to the index hand through a considerable arc, which renders it difficult, if not impossible, accurately to judge of the pressure within the boiler; they also speedily wear away the teeth of the rack and pinion by friction, the one upon the other. This vibration of the index hand is considerably augmented by the water of condensation which is allowed to collect and remain within the tube, and which materially increases its weight and momentum.

To diminish as far as possible the vertical vibrations of the tube, as well as to do away with their influence upon the index hand, is the object of the second part of this invention, which consists in joining the pipe through which the pressure within the boiler is transmitted to the gage with the indicating tube at a point between the two ends of the tube, and bending the latter upon opposite sides of a vertical line passing through its junction with the pipe, whereby the tube is rendered less sensitive to the effects of the vertical shocks to which the locomotive is subjected. The length of tube which the inventor has found to be least affected by these shocks is nearly a complete circle, to which, at a point midway between its ends the pipe from the boiler is joined, the two ends of the tube approaching each other at the top, where they are connected with the lever which transmits their motion to the index hand.

In Fig. 1 is represented the improved gage, the dial plate being removed. The pipe through which the pressure is brought from the boiler is attached to the indicating tube at the bottom. For the purpose of carrying out the first part of this invention, the two branches, 1 and 2, of the indicating tube are made of a length not exceeding a semicircle, while they are both so placed as to descend at every point towards their junction with the steam pipe, that the water which may condense within the tube may drain back to the pipe.

To diminish, as far as possible, the vertical vibrations of the indicating tube, and to lessen their influence upon the index hand, the steam pipe is joined with the tube at a point between its two extremities, and the two branches, 1 and 2, are bent upon opposite sides of a vertical line passing through the lower part of the tube, the extremities of the tube being nearly over the points where the tube is rigidly supported. The tube is formed of two branches, 1 and 2, which are bent symmetrically upon opposite sides of the vertical line, that their motions in a horizontal direction may coincide as nearly as possible with each other. The lever, *i*, through which the contracting and expanding motion of the tube is transmitted to the index hand is pivoted to one of the branches (1) of the tube at its end, the extremity of this lever being pivoted at *r* to a connecting arm, *g*, the other end of which is pivoted at *c* to the branch (2) of the tube; the lower end of the lever, *i*, is pivoted at *r* to the rack, *m*, which engages with a pinion, *n*, upon the arbor of the index hand, P. When thus constructed and connected, it will be observed that upon the occurrence of a shock in a horizontal direction both branches move equally, or very nearly so, in the same direction, carrying with them the upper end of the lever, *i*, which not being pivoted to the case or other rigid part of the gage, simply turns round the pivot at its lower end, without influencing the rack, *m*, or the index hand. This loose joint between the lever, *i*, and the rack, *m*, is also important for the purpose of preventing the motion of the joint at the end of branch, 1, from causing the rack to bind upon the pinion, *n*, or to disengage itself therefrom.

Horses and Billiards—Rarey and Berger.

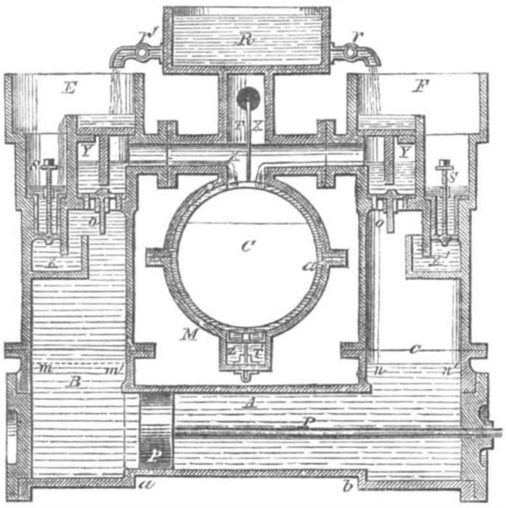
Two of the greatest masters in their professions in the world are at present exhibiting their skill to thronged audiences in this city. Rarey, the American horse-tamer, who astonished all Europe with his wonderful skill in breaking vicious horses, is holding levees three times a week at Niblo's Garden, to crowded and delighted audiences. Berger, the corpulent Frenchman, whose wonderful feats with the cue we noticed at some length on page 249 of our last volume, has returned to this city after a month's absence, and is delighting the billiard players at the private room of Mr. Phelan (the renowned professor of the art of billiard playing, and extensive manufacturer of tables), on the corner of Tenth-street and Broadway. Any of our city readers who are fond of the horse or billiardscannot but be delighted by an attendance on the exhibition of either of these professors, as their tastes may direct them.

An American, who calls himself Dr. S. V. Bly, is astounding the Parisians by his power of reading any letter or other writing inclosed in any number of sealed envelopes.

JOHNSON'S PUMPS FOR COMPRESSING ELASTIC FLUIDS.

[From the London Engineer.]

This invention, communicated to Mr. Johnson, by Mr. Sommeiller, of Turin, relates to a peculiar construction and arrangement of apparatus for compressing air, gases and other elastic fluids, and consists in the employment of a horizontal cylinder, opening at both ends into two vertical cylinders respectively. A piston is caused to work to and fro by any prime mover along the horizontal cylinder. This last mentioned cylinder is filled with water, which also partially fills the vertical cylinders; the piston is thus entirely closed by water on both sides. The two vertical cylinders are each provided with a pair of valves kept hermetically air-tight by hydraulic joints, the valves and valve seats being constantly covered with water. One of each pair of valves serves as the inlet for the air or gas to be compressed, and the other allows the compressed air or gas to escape into a pipe leading to the compressed air or gas reservoir. The to-and-fro motion of the piston in the horizontal cylinder causes a simultaneous elevation of the water level in the one vertical cylinder, and a corresponding depression of the water level in the other cylinder. As the water level descends, the external air (if it is sought simply to compress atmospheric air) enters the cylinder by the inlet valve, at the same time a small quantity of the water which surrounds that valve escapes into the cylinder with the air, and at the next stroke of the piston the raising of the water level compresses the air above the water in the cylinder, and forces it through the outlet valve into the pipe leading to the reservoir or air vessel; a small escape of water again taking place with the air out of the cylinder. It is thus obvious, that during the working of the apparatus, there is an intermittent entrance of water into the cylinders, and a corresponding escape of water therefrom. This supply



may be maintained by any natural and constant source, such as a mountain stream, and the water which escapes flows into a reservoir fitted with a float and valve, so that when a certain quantity of water has run into the water reservoir, the float will rise, open an escape valve, and allow the water to run off until the descent of the float again closes the valve.

A is the horizontal cylinder, within which works to and fro the piston, P, actuated by any convenient prime mover. This cylinder opens at both ends into the compressing cylinders, B and C, respectively; M is a horizontal cylindrical reservoir, in which is placed a cylindrical float, C, a free space, *a*, being left between the exterior of the float and the interior of the reservoir, as shown in the drawing; R is a water reservoir or tank, which is kept constantly supplied from any natural or other convenient source, and is provided with two cocks, *r r'*, which direct the water into the two vessels, E F, respectively; S and S, are two inlet valves for the entrance of the air or gas to be compressed into the compressing cylinders; O O are two other valves, which admit of the exit of the compressed air or gas from the compressing, respectively; and *z* is another valve fitted into the bottom of the reservoir, M, and connected with the float, C, for the purpose of effecting the periodical emptying of the reservoir, as hereinafter described; T T' are two horizontal tubes or passages, one serving to conduct the compressed air or gas to any suitable accumulating reservoir, which is not represented in the engraving, and the other serves to carry off the water which is operated in the compression of the fluid. The piston works to and fro in the water, which always maintains an air tight joint, and the tightness of the valves, S S and O O, is also maintained perfect by keeping them constantly immersed in water by the aid of the respective vessels, X X and Y Y, which are always maintained full of water at a constant and invariable level, which water effectually prevents the return of the air or gas, whether at the inlet or exit valves. The compressed air or gas in the cylinder or compressing chambers, B and C, passes out by the valves, O and O, simultaneously with a small quantity of water, which is carried along with it mechanically, and expands in the space, X, whence it passes by the tube, T, into the receiver or magazine. The small quantity of water which is carried over by the air into the space, X, serves to keep the vessels, Y Y, constantly supplied, the surplus water flowing off into the reservoir, M. When this waste water has attained a certain level in the reservoir, M, it elevates the float, C, which draws with it and opens the emptying valve, X, through which the water escapes by the aid of the tube, T, and under the pressure of the air or gas in the space, X, above. The escape of the water causes the float, C, to descend again and so close the valve, *z*, until the further supply of water again elevates the float and valve. Thus the water supplied by the cocks, *r r'*, in two continuous jets, after having fulfilled its purpose of packing or keeping air tight the inlet valves, is expelled intermittently and automatically from the apparatus at the same time with the water carried along by the compressed air.

Although the constant admission of fresh cold water into the apparatus might be objected to as tending to a certain extent to diminish its useful effect, yet this entrance of cold water acts beneficially in other respects by keeping down the temperature of the apparatus, as it will absorb the heat generated by the compression of the air or gas. Supposing the apparatus to be started, the piston, P, will travel from *a* to *b*, and the outlet valve, O, of the chamber, B, close. This cylinder, B, is completely filled with water, whilst in the cylinder, C, the water reaches only to the level, *n n'*; the remaining part of this second cylinder is filled with air or gas, as the case may be. Now, during the course the piston travels, from *a* to *b*, the level, *n n'*, will rise and compress the air above it until it forces open the outlet valve, O, and escapes in the space, X, and thence by the tube, T, to the receiver. On the arrival of the piston at *b*, or the end of its stroke, the valve, O, closes again, and is kept tight by the presence of the water which covers it in the vessel, Y. Should this valve be imperfectly made, a leakage or black flow will take place through it, during the return stroke of the piston, from *b* to *a*, but this leakage will only be a small quantity of water, and not of the compressed fluid inclosed in the space, X. Whilst the piston has been travelling from *a* to *b*, the inlet valve, S, of the cylinder or chamber, C, has, of course, remained closed, and been kept air tight by the water in the vessel, X, in which this valve is immersed. In the same manner described, with reference to the valve, O, and leakage through this valve will merely result in the escape of a small quantity of water, whilst the compressed fluid itself is retained in the cylinder. The operation of the cylinder, B, during the return stroke of the piston from *b* to *a* is precisely similar to that already described in reference to the cylinder, C, but it has in the meantime been filled with air or gas through the inlet valve, S, and its water level has descended to the line, *m m'*, so that when the piston begins to move from *b* to *a* the air or gas above *m m'* will be compressed and forced out eventually through the outlet, O, into the space, X, and receiver. Whilst this is taking place, the level of the water, C, is descending, and a fresh supply of air or gas is entering by the inlet valve, S. The volume of air which enters and is expelled from each cylinder, B C, alternately, is, of course, equal to the volume of water expelled at each stroke of the piston.

Licorice Growth in Texas.——We learn from the San Antonia *Ledger* that a Mr. Poinsard, of that city, has been eminently successful in the culture and acclimation of licorice root, which he has had imported from France. Of all the plants imported, one only survived. The growth was luxuriant, notwithstanding the drought, covering the ground for a circumference of fifteen feet, irrigation being unnecessary.

Our Correspondence.

Holcomb's Electro-Magnet.

Messrs. Editors:—In your paper of Jan. 12, 1861, you publish, under the head of "Telegraph Magnets," a communication signed W. J. R., in which the writer refers to my "Combination Magnet," recently illustrated and described in your journal.

The writer, after saying that he does not think it will be an advantage, goes on to say that a varying current is a great source of trouble to operators; and if some one would invent an apparatus that would counteract its effect, it would be appreciated. He also attributes this difficulty of adjustment to permanent magnetism, and *italicizes* the remark that a relay pretty strongly charged with it, "will not work with a very weak current." Now, as there is no effect without a cause, let us consider what the true cause may be.

When the electro-magnet retains its magnetism, after the electricity ceases to pass through its helices, it is because the cores are not made of pure and well annealed iron; consequently, they take magnetism slowly, and part with it in the same manner: hence the confusion and difficulty of adjustment with a varying current. Another cause is, currents of electricity passing through the helices, sometimes from the ground to the atmosphere, and at other times from the atmosphere (or the clouds that pervade the atmosphere) to the ground. There is another difficulty to be encountered. When a current is transmitted a long distance, it becomes protracted—so much so that the signals, if rapid, become blended together; that is, the electricity does not cease to flow through the helices of the receiving magnet during the interval between the transmitted signals. The wind, hail and rain also produce currents of electricity in the wire by friction, and the line itself is a battery of uncommon magnitude. Take, for instance, a galvanized wire connecting New York and Boston; there would be a zinc surface exposed to the atmosphere equal to about one acre. In a damp atmosphere, every square inch of this would excite sufficient electricity to operate a relay magnet with all the rapidity required for telegraphic communication; consequently, in a rainy day there would be a power sufficient to operate 6,272,640 magnets. Owing to various causes, this power may not always be apparent in the offices; yet, such is the arrangement of the zinc-coated wire with the ground plate that, with a damp atmosphere, they possess all the elements of a galvanic battery.

I mention these facts to show that all the difficulties experienced are not due to permanent magnetism. W. J. R. refers to my table as showing the difficulties of adjustment to be very much increased. I certainly cannot see how such a construction can be put upon it. While the permanent magnetism remains the same, which the table shows, the counteracting tension can also remain the same, whether there be a weak or a strong current, provided the following principles be observed: The armature should be in a state of equilibrium during the normal condition of the magnet, and the tension of the spring, while offering no resistance to the armature at starting, should increase in the same proportion as the varying force of the magnetism.

But one word in regard to that misunderstood table, which was published in the hopes of provoking an investigation by some one that was better acquainted with the various phases of magnetism than myself. I wished to show by it that *one* electro-magnet, strongly charged from a permanent steel magnet, is nearly *twice* as powerful, and will work with a weaker current, than when a steel magnet is *not* used. Respectfully yours, A. G. Holcomb.

The "Original" Revolver—Colt's Patent, &c.

Messrs. Editors:—I notice that a correspondent of the Petersburg (Va.) *Daily Express* has come to the conclusion that the original revolver of the Colt style is the one described by that celebrated traveler, Bayard Taylor, in his book entitled "At Home and Abroad." From what this distinguished gentleman says, I am led to believe that he is of the same opinion. My object in writing this letter is to deny that conclusion, and to point out the genuine, original revolving firearm. I will quote Bayard Taylor's words:—

Warwick Castle, only six miles distant, offers a remarkable contrast to Kenilworth. Like the latter, the date of its foundation is unknown, and its most ancient part bears the name of "Cæsar's Tower;" but, while Kenilworth is fast crumbling to pieces, this remains entire, and is inhabited in every part. * * * We saw, also, the armory, which is usually closed to visitors. It is rich in the ancient armor and rare and curious objects, among which I may mention the crystal-hilted dagger of Queen Elizabeth, her skirt of chain mail, her saddle and the trappings of her horse: but I was most struck with two things—*a revolving musket*, more than two hundred years old, and a mask taken from the face of Oliver Cromwell after death. The revolver (of the antiquity of which there can be no doubt) is almost precisely similar to Colt's, having a single barrel to which is attached a revolving cylinder containing six chambers. There is a flint lock and pan to each chamber, and the firing of one discharge brings the succeeding chamber to the barrel. I had been aware of the existence of this curious weapon, but was not prepared to find the idea of a revolver so perfectly developed. (*Page 56 and seq.*)

The original one, similar to Colt's in style, is in existence at the present time, and was on exhibition at the Mechanical and Agricultural Fair at Newbern, N. C., in 1859. The inventor was a poor man (a blacksmith), and scarcely could get the necessary funds to pay his traveling expenses and for his patent. His friends (?) laughed at his folly—the absurdity of spending what little money he had in such a reckless manner. He finally started, but between Richmond and Washington City he lost his fortune.

It is useless for me to say more; the balance of the story may be imagined. The poor man returned home to be laughed at and scorned and reproached for his shallowness of mind. Alas! poor Gill, the blacksmith, died, and was buried

"Unwept, unhonored and unsung."

Any information concerning this revolver can be obtained by addressing the Mayor, Frederick Lane, or the Matthews family, at Newbern, the latter of whom own this "implement of warfare." The one intended and used as a model has *fourteen* chambers, instead of five or six, as have the most of Colt's make. The barrel is brass. While I was editing the Newbern *Gazette*, I kept putting off my description and illustration of this instrument until the paper was discontinued. Revolving fire arms have an *origin*, and the nation should know who is the original inventor. I am, &c.,

Thomas R. Murray.

Lake Landing, N. C., Jan. 12, 1861.

A Grateful Inventor.

The annexed letter, from an ingenious inventor who has just received a patent, we recommend to the perusal of any person who is about to apply for Letters Patent, and has not decided whom to employ as his attorney to prepare the necessary drawings and specifications, and act as his agent before the Patent Office:—

Messrs. Munn & Co.:—Your favor came duly to hand, and, in response, I must acknowledge my thanks and indebtedness to you, which I hope you will accept as part equivalent so justly due you for the unwavering energy and untiring zeal manifested in my case. I must also confess that I am highly delighted with the drawings in my Letters Patent; indeed, nothing in their line can excel them in point of beauty and systematic order. And, more than this, you have discharged your duty toward a dependent client nobly; indeed, you have accomplished more than I could even hope for, and that in regard to my claims, one of which I expected would be among the missing. Since my first patent, I have received many solicitations from other Patent Attorneys, but preferred placing my case under your own personal supervision, and in that I have not been disappointed; and I am glad that I have done so. I recommend to all my brother inventors (especially those that may not be so well advised in relation to your excellent facilities as I am) that, should they be so fortunate as to place their case in your hands, they may rest assured that they have made a safe investment, as far as the procuring of the patent is concerned. Respectfully, yours, J. McNamee.

Easton, Pa., Jan. 5, 1861.

Inventors Busy, but Patents Diminishing.—We are receiving vast numbers of letters describing new improvements from every section of the country, which evinces activity among the inventors; but the numbers who apply for patents have latterly somewhat diminished, as the reader will infer by the number of patents issued weekly and reported in our columns. The number of patents issued last week, and reported on another page, is only twenty-nine, thirteen (or nearly one-half) of which number were solicited through this office.

Column of Varieties.

A Paris correspondent writes of a billiard table invented there which may be used as a dinner table, a chest of drawers, a bed, a bathing tub and a stove.

Iron pipes, when laid in the ground and packed all around with dry clay, do not rust. The clay protects the metal from the action of oxygen in moisture and air.

Brown sugar can be bleached nearly white by placing it in a close chamber and submitting it to the action of sulphurous acid vapors, which do not injure its quality.

The steam tunnage of New York is 120,589 tuns, mostly marine. The next port in importance is New Orleans, the steam tunnage of which is 75,789—mostly river boats.

The entire continent of Australia has been recently crossed for the first time by white men. This was accomplished by J. Macdonald Stewart, of Edinburgh, and two attendants.

The steamship *Tennessee*, which sailed from New Orleans for Vera Cruz lately, took a large quantity of material for the new railroad from Vera Cruz to the neighboring village of Medellin.

A prize of $2,500 is offered by J. Silversmith, of San Francisco, Cal., for the discovery of a process whereby gold and silver can be profitably separated from the sulphurets of California.

The new Armstrong guns cost the English government $10,000 each. For their construction, a grant of $10,000,000 had been made by Parliament, of which the greater part has been expended, and 451 guns of every caliber made.

At ordinary atmospheric temperature, the conducting power of pure copper is to that of hard drawn silver as 93 to 100. Annealed copper wire is superior to hard drawn wire, the former being to silver as 97 is to 100.

The Commissioners of Sewers in London have granted to our countrymen, Mr. G. F. Train, permission to lay down a single line of horse railway in Moorgate-street, and a double line in Finsbury-place, running northward to the boundry of "famous London town."

Sacramento, Cal., is the Cincinnati of the Pacific regions, in the way of demolishing porkers. There are several pork-packing establishments in that city, each of which takes down about 80 grunters per diem during the hog harvest.

Although copper is inferior to pure silver for conducting electricity, strange as it may seem, it loses some of its conducting power when alloyed with silver or any other metal. This has been determined by a series of experiments communicated to the Royal Society by Professor Wheatstone.

The French Minister of Finance has announced, by advertisement, that we will receive, on the 18th of next month, tenders for 3,000 tuns of Virginia, 4,500 tuns of Kentucky, and 1,500 tuns of Maryland tobacco.

A line of telegraph is about to be constructed between Teheran and Bagdad, so as to connect Persia with Europe by the electric cord. Persia is becoming civilized; the capital of the Mohamedan empire, secluded on the banks of the Euphrates, is opening its bosom to receive improvements.

When arsenic is thrown upon melted copper, a small part of it volatilizes; the greatest portion of it is absorbed and forms an alloy of a gray color, very hard and brittle. Sulphur, selenium and tellurium, mixed with copper, render it so rotten that it cannot be drawn into wire. All these substances should be carefully avoided in smelting copper.

The Mobile Wine Company report that, should the season be favorable, they expect to make this year 10,000 gallons, or 500 gallons to the acre. The actual stock of the company is now $20,000. It is proposed to add to this $10,000. During the two years which the company has been in existence, the stockholders have paid in 40 per cent on the capital subscribed.

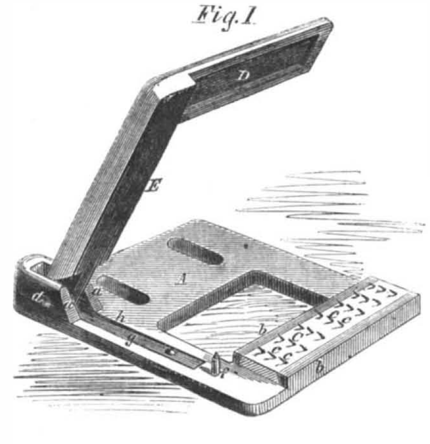
A distinguished physician lately announced that one reason why so many people have the dyspepsia is because they have *no sympathy* at table. They eat alone at restaurants, and devour their food like wild beasts, instead of sitting at the table with their families, where their sympathies would be called into healthful activity, and where they would eat like civilized beings. There may be something in this idea. At any rate, it would do no harm to test it.

TILTON'S IMPROVED TEMPLE.

There is probably no other piece of mechanism of equal simplicity which has been the subject of so much study as the power loom. There being thousands of these machines in constant operation, under the supervision of skillful and intelligent mechanics, every part and motion has, under the impulse of the patent laws, been the theme of a great deal of thought and contrivance. As the cloth is woven, it is necessary that the sides should be stretched apart to prevent the web from becoming narrow and uneven, and the mechanism by which this office is performed is called a temple. The fact that there are several classes of these little implements, illustrates, in a forcible manner, the truth of our assertion in regard to the invention which has been bestowed upon the power loom. The improvement which we here illustrate is in that class of temples known as the spur plate temple. The inventor says that, though it seems to be the plan which a person would naturally adopt at first for making a temple, its production has cost him five years of reflection and experiment; an additional proof to the thousand others of the general tendency towards simplicity in mechanism.

Fig. 1 of the annexed cut is a perspective view of the whole implement, and Fig. 2 is a sectional view, showing the manner in which it grasps the cloth. The invention consists in inserting the teeth of the temple into a piece of wood, which is fitted to the plate of the temple in such a manner as to be removable for the purpose of renewing the teeth when worn out or injured.

Fig. 1



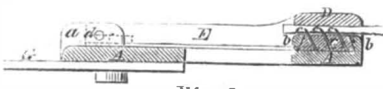


Fig. 2

The piece of wood, C, is made of both tapering and dovetailed shape, to fit into the space of corresponding form between the two projections, *b b*, which rise above the surface of the plate, A. Passing through the wood from the lower side, are the pointed steel teeth, *c c*. These teeth have both a forward inclination towards the breast beam, and an outward inclination toward the side of the loom, which position prevents the cloth from slipping back, and also prevents it from slipping off the teeth in a lateral direction, as it is stretched by the action of the reed when the latter beats up the filling. The piece of wood, C, being easily removable, it can be renewed with a set of teeth when these are worn out, or any broken or injured tooth can be replaced without taking the temple from the loom.

The cap, D, which is made in one piece of metal with the arm, E, confines the cloth to the teeth, *c c*; it has a depression over the teeth so as not to come in contact with the latter, and it is held either open or closed by the spring, *g*, which presses against its short arm beyond the fulcrum pin, *d*. A short stud, *f*, fits into a hole in the arm, E, to hold the cap securely in place when the temple is closed. The temple is attached to the breast beam of the loom by the stout spring, G.

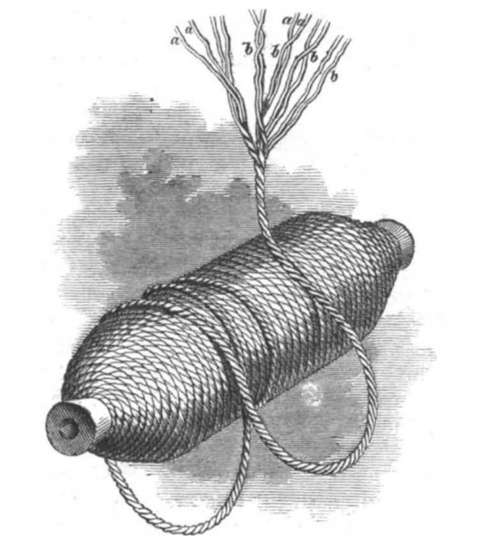
To persons wholly unacquainted with the matter, this may seem a small modification to be secured by Letters Patent, but those who understand the value of improvements in even the details of mechanism which is in extensive use, will readily believe that it may be a means of independence to the ingenious inventor.

The patent for this invention was granted, through the Scientific American Patent Agency, Dec. 11, 1860, and further information in relation to it may be obtained by addressing the inventor, Jeremiah C. Tilton, at Sanbornton Bridge, N. H.

WORTENDYKE'S IMPROVED WICKS FOR CANDLES.

The object of the invention here illustrated is the production of a wick which will burn in tallow candles, as well as in those of less fusible material, without snuffing. This wick also requires less weight of material than those in common use.

For accomplishing these objects, the simple plan resorted to is to make the wick of several strands, *b b b b*



(see cut), each of which is formed of two or more yarns, *a a a a*; the strands being twisted in the same direction as the yarn, and the wick being twisted in the opposite direction to the strands.

When we consider the immense number of candles which are consumed in this broad country, we shall realize that a decided improvement in wicks is an invention of very great value.

The patent for this invention was granted, through the Scientific American Patent Agency, on Jan. 1, 1861; and further information in relation to it may be obtained by addressing the inventor, C. A. Wortendyke, at Godwinville, N. J.

Death of Professor Hackley.

We regret to announce the decease, on the 10th inst., of Professor Charles W. Hackley, of Columbia College, this city. At a comparatively early age, he was cut off in the full vigor of his intellect, and called away from scenes of great usefulness at 52 years of age. He was educated at the military academy of West Point, and was teacher of mathematics there for several years. From 1833 to 1839 he filled the chair of mathematics in the University of New York; then he became president of Jefferson College, Mississippi, from which place he came to Columbia College in 1843, and at his death was professor of astronomy. He was the author of several elementary works on science, and took an interest in all that related to astronomy and mathematics. He exerted himself in directing the attention of the public to the importance of erecting an astronomical observatory in this city. Applying the principles of acoustics to rooms designed for public speaking, he projected the method which has lately been introduced into several churches of the city, consisting of a sounding board which throws forward the voice of the speaker among the audience. His death was occasioned by a nervous fever. He leaves a large circle of friends, whom he had won by his kindness of heart, his gentleness of manners, and his useful life.

FRATERNAL.—The *Country Gentleman*, published at Albany, N. Y., by the veteran Luther Tucker and his son, in alluding to the prosperity of its agricultural cotemporaries, the *Maine Farmer*, *Moore's Rural New Yorker*, the *American Agriculturist*, and *Miner's Rural American*, says that "among our non-agricultural exchanges, the *Home Journal* and the SCIENTIFIC AMERICAN are to be ranked among the most perfect specimens of the art of printing we receive in newspaper form." This is certainly a high compliment, the correctness of which, as applied to this journal, our readers can judge. From our own knowledge of the *Home Journal*, we are certain that the *Country Gentleman* is correct. Messrs. Morris & Willis, and their famous *Home Journal*, are known everywhere. A new volume has just been commenced.

Human Power over Brute Force—Rarey's Method of Taming Horses.

The mode by which J. S. Rarey, the world-renowned subduer of wild and vicious horses, accomplishes his marvelous feats has been very widely discussed, and it is now being practically exhibited by him at Niblo's Garden, in this city, by the taming of the very worst horses that can be found. His treatment consists in two things—first, in showing the horse that he is in the man's power, and second, in convincing him that the man means him no harm. In order to obtain absolute physical power over the horse, the simple plan is adopted of bending his fore legs and securing them by straps in this bent position. This of course throws the horse upon his knees, in which position he remains but a short time before he becomes so much fatigued that he rolls over upon his side. The tamer now handles him gently, patting and stroking him, fondling his head, putting it under his arm, turning him about on his side, &c., until the horse is thoroughly satisfied that the man is kindly disposed towards him, and has no design of doing him any injury. When these two ideas are fully implanted in the horse's mind, that the man can do what he will with him, and that he will not use this irresistible power to the horse's hurt, the work is done—the horse is subdued. To overwhelming power, combined with perfect kindness, he yields prompt and absolute submission.

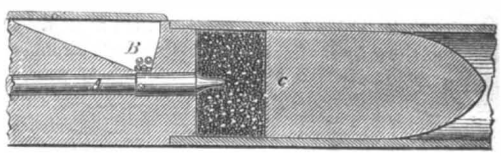
At Mr. Rarey's first exhibition in this city, a muzzled horse was lead in by two grooms, which was such a vicious animal that he had not been used in four years. He had both the wicked habits of kicking and biting. In just thirteen minutes from the entrance of the horse upon the stage, Mr. Rarey laid his head between the horse's heels and placed his arm in the horse's mouth!

Fitzgerald & Bate's Method of Igniting the Charge in Ordnance, &c.

This invention of Mr. Fitzgerald, of Cambridge-street, and Mr. George Bate, of Great George-street, conists in firing the charge in cannons, muskets, and other firearms, by means of two chemical substances or compounds, by which fire is generated as soon as the substances come into contact with each other, by percussion or otherwise. By way of exemplification, we will describe one arrangement of gun and one set of chemical substances, which the inventors find to answer well in carrying this invention into effect.

In an angular direction through the breech is formed a tubular aperture, and to the front of the hammer of the lock is hinged a pin or bolt, which fits accurately in this aperture. Over and opening into this aperture, at a point in front of the inner end of the bolt, when the hammer is drawn back or at full cock, is placed a reservoir or hopper, and in this hopper globules formed of a mixture of chlorate of potash and sulphuret of antimony, in or about the proportion of two parts (by weight) of the former to one of the latter, with a sufficient quantity of gum, gelatin, or other like suitable agent, as a vehicle for forming the composition. The opening from the hopper is so calculated as to allow passage to one globule only at a time into the tubular aperture, and then only when the hammer is at full cock.

The back end, or the paper intended for application



to the back end of the cartridge, is prepared by applying a coating of a composition formed of about one part of phosphorus (by preference amorphous phosphorus), one part of sulphuret of antimony and two parts of emery powder, with liquid glue, gelatin, gum, or other like agent. These materials are compounded under a degree of heat sufficient to melt the phosphorus. In some cases they apply the paper to a wad at the back end of the cartridge. In the accompanying engraving, A is the plunger in connection with the trigger of the gun, B is the reservoir for the globules, and C is the cartridge. In the case of ordnance, the patentees prefer to ignite the charge by inserting in the vent hole a tube partially lined with the prepared paper described, which is brought into frictional contact with a portion of the compound used for making globules.

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VOL. IV. NO. 4......[NEW SERIES.]....*Seventeenth Year.*

NEW YORK, SATURDAY, JANUARY 26, 1860.

FIREARMS AND RIFLE BREECH LOADERS.

The subject of firearms has engaged much public discussion during the past few years, and it is now attracting more attention than ever. Nearly all Europe appears to be an armed camp. England has two hundred thousand volunteer riflemen in constant drill; and at home, the notes of warlike preparations resound throughout the land. For two centuries, the free yeomen of America and the sturdy Switzers of the Alps were alone distinguished for skill with the deadly rifle ; but it has now become the weapon of all armies, and there is no nation which can claim prëeminence in the skillful use of it. The first correct writer on the rifle was Robbins, an English soldier, who wrote upon the subject about a hundred years ago. He explained the defects of the smooth bored musket, described the principles of the rifle, pointed out its superiority, and declared that, by whatsoever army it was adopted, "wonderful effects would follow." The theory of the rifle is now generally known, and the advantages of this weapon are duly appreciated. But there are great and essential varieties of rifles, and, of course, all cannot be equally good. There are breech-loading and muzzle-loading rifles; there is the light English rifle, with its smooth tapering barrel: the heavy Swiss rifle, with its thick breech and muzzle; and the long heavy American rifle, with its octagon barrel. There are also very great differences in the pitch of rifle grooves, and other features which are far from being unimportant. On these points much has been written that is more discursive than instructive. J. Chapman, author of the "American Rifle," and Colonel Jacob, of the East India army, are perhaps among the best writers on this subject. A series of articles on small arms has also been lately published in the London *Mechanics' Magazine*, by W. Bridges Adams, a practical engineer and writer on mechanical subjects. Some of his views are full of good sense, while others exhibit a want of thorough practical acquaintance with rifles.

European writers on firearms seem to be unacquainted with what has been done in America by our gunsmiths. The conical or elongated Minié projectile, which has become the favorite in Europe, is the old picket bullet used by American riflemen, with the addition of a chamber and plug in its stern. Adams' says: "All forcible expansion of leaden bullets within the barrel by the explosive action of the gas is a mistake—it wastes powder and alters the form of the shot into irregularities, tending to irregular flight." He thus declares that the expanding bullet is not reliable for accurate shooting. We have seen several experiments made with the expanding and the old solid picket bullet loaded at the muzzle, in which the latter always proved the most reliable. It must be acknowledged, however, that the expanding ball has its advantages in warfare. With it, a soldier can load his rifle as easily and as fast as a musket ; and if it is not quite so reliable, it is better for rapid firing than the solid ball. But it has no other advantage than this ; and above all things, certainty of striking should be the first object in firearms; quick shooting if we can, but accuracy by all means.

American first class rifles are the best in the world. The foreign Enfields, Whitworths and Lancasters are far inferior to them. The reason of this is obvious. Rifle shooting has been a favorite American amusement for a hundred years, and it has been a matter of national pride, as well as of security, to excel as marksmen. The greatest care and the highest mechanical skill have been called into requisition on the part of our gunsmiths to make perfect rifles, and they have been successful beyond all that Europe can boast. A Wesson, a James' or a Fish rifle is always a "dead shot" in the hands of American marksmen: the instrument, when in proper order, never fails.

At present, we believe that the muzzle-loading rifle, with the tight fitting conical bullet, is the most reliable, and the principles involved in its construction are few and simple. The barrel should be of the best close-grained cast steel, and its weight sufficient to give it stability. It also appears to be advantageous to have the barrel of an octagon form, and of the same diameter from end to end. When the charge expands in the barrel of a rifle, a series of undulations are produced, which operate to give irregularity to the flight of the projectile. The angles of the octagon rifle barrel tends to arrest these undulations. This was discovered long ago by our backwoods' marksmen; but this principle does not seem to be appreciated by most army officers, who have provided round barrels for their rifles. The size of the bore in rifles is a matter of convenience and choice. The larger the bore the greater proportionately should be the weight of the barrel, to give it stability. The interior of the rifle should be as smooth and polished as the inside of a steam cylinder, to avoid friction in the passage of the bullet. There is quite a difference of opinion as to the best length for rifle barrels. This is an important feature, because the pitch of the rifling is always in accordance with the length of barrel. The heavy, long western rifle, with its moderate spiral, is considered by many persons to be the most reliable; while others assert that a short barrel, with a slow starting spiral and an increasing twist towards the muzzle, is as reliable, and is preferable to the long barrel. The number of grooves in a rifle is not of much importance—three are better than a dozen—provided the bullet be made to spin properly; they should be as shallow as possible, however, to prevent windage. The German rifles have short barrels and a rapid twist. Colonel Jacob states that he found, by many experiments, that a barrel two feet long, with the grooves full and of a breadth equal to the *lands*, and giving a revolution once in three feet, was equal to barrels two and a half and three feet long. The muzzle of a rifle should be perfectly true ; for if there is the least defect at the issue where the bullet leaves the barrel, shooting becomes mere chance work. Clark's patent loading muzzle—an American invention—has conferred a superiority for accuracy on all rifles furnished with it.

It is admitted that rapid loading is desirable, and that this is obtained with expanding bullets; but these are not reliable. But, then, are not accuracy and rapidity of firing combined in breech-loading rifles? The late Secretary of War, in his report, said: "I think it may be fairly asserted now that the highest efficiency of a body of men with firearms can only be secured by putting into their hands the best breech-loading firearms." This conclusion, it seems, was arrived at after a great number of experiments by army officers. There can be no question as to the ease and rapidity of loading breech-loading rifles, but they are not considered so accurate in firing as a good muzzle-loader. We have seen several trials of skill with the two kinds, in which the breech-loader usually failed; and yet we do not see why this should be considered a settled question. There is nothing in theory, and there should be no positive difficulty in practice, to prevent a breech-loading rifle from being made to carry as accurately as any other. We shall recur to this subject in a future article.

THE NEW COMMISSIONER OF PATENTS.

The inquiry is frequently made of us, who is likely to be appointed Commissioner of Patents under the incoming administration ? Our readers are deeply interested in this matter, and in view of the vast and increasing importance of the interests over which the Commissioner of Patents is called to preside, the inquiry is a pertinent one. We are not in the counsels of the acting President or President elect, and have therefore no authority to speak for them. This much, however, we will say, that the appointment of a Commissioner of Patents is an important matter, and it ought not to be conferred merely to provide a place for some windy political demagogue, as a reward for stump services. Neither should the selection be made of one who has searched into the profound mysteries of some science and knows but little else. The duties devolving upon the head of the Patent Office are somewhat peculiar, and require "the right man for the right place." He must have considerable patience, a willing ear, and a firmness of purpose not to be wheedled out of the path of progress into old fogy notions. He must have not only a knowledge of law, but he ought also to be able readily to distinguish the difference between a cheese press and a hydraulic ram, and even, to go further, when necessary, to protect the rights of an inventor by overruling wrong decisions. His habits, conduct and language ought to be high-toned and above suspicion. In short, he ought to be a gentleman, possessed of good common sense, having a generous appreciation of the interests of inventors, so as to welcome them to the Patent Office in free and frank intercourse ; and if an inventor should happen to suggest that his rights had not been fully respected, not to swear behind his back, nor consider it an attempt to cast odium upon a high public functionary. There are plenty of solid men in this stirring country, possessed of all the desirable qualities herein mentioned, and who would, doubtless, cheerfully accept the appointment if tendered them.

The only name we have heard suggested for this office is the Hon. Butler G. Noble, of Wisconsin. From what we know of this gentleman, we should think he has all the elements necessary to make an admirable Commissioner. He is a lawyer by profession, and has a knowledge of the arts and sciences surpassed by few men in the country, to say nothing of his capacity for work and his readiness to do his whole duty.

Mr. Thomas, who retired from the Patent Office to assume the duties of Secretary of the Treasury, has resigned his new office, and it is stated in the *Daily Times* that he would probably again resume the duties of Commissioner of Patents. This we consider wholly improbable under the circumstances. The duties of the Patent Office are now acceptably performed by Mr. Shugert, and we hope no one will be placed over him. We should be most happy to announce the determination of Mr. Shugert to abolish that useless appendage, the "revisionary board," and inaugurate some other changes in the Office such as would relieve it from suspicion of imbecility at least.

THE FERTILITY OF INVENTORS.

We published last week an illustration of the mode of spiking cannon, and it would surprise any one who has not come in actual contact with the inventive genius of the country, to learn the number of suggestions which have been made to us of improvements in this simple operation, both for spiking cannon and for restoring them again to usefulness. If the attention of our inventors is called to the need of any improvement, however difficult of accomplishment it may appear, it is surprising how promptly some means of effecting it will be devised. A few years since, an extensive worker of marble, in New Hampshire, offered, under special conditions, a reward of $10,000 for a machine for sawing marble in a particular manner which it had been deemed impossible to effect by machinery, and the plans poured in upon him in such abundance, that he was not only embarrassed with scores of personal applications, but had so many letters upon the subject, that he was led to exclaim, "Hold, enough!"

Very many of the operations which are now regularly performed by machinery, would have been regarded, a few years ago, as absolutely beyond the power of mechanism. Who would have thought, for instance, that a peck of pins could be poured into a hopper, and that a machine would take them all by the heads and insert them in straight rows into papers, with a rapidity and regularity unapproachable by hand work? Here is a loom, driven by a powerful water wheel or steam engine, and running with great force, weaving with rapidity a very slender cotton thread into a web, and if the tender thread breaks, the loom instantly stops. A piston is moving back and forth in a steam-tight cast iron cylinder, and the varying pressure of the steam, throughout every portion of the stroke, upon each square inch of the inside of the cylinder, is accurately recorded by the engine itself upon a sheet of paper with a lead pencil. What man can pronounce any mechanical or scientific achievement mpossible who reads every day, in his morning paper, he news sent from all parts of the country by that perpetual wonder and miracle, the electric telegraph!

If any person perceives an opportunity in any art for an improvement which would be of unquestionable money value, or any operation which it would be profitable to have performed by mechanism, however impossible it may seem to effect it, let him write a short note to the SCIENTIFIC AMERICAN, calling the attention of our readers to the matter, and we can almost insure him a speedy solution of the problem. Difficulties only stimulate the resolution and ingenuity of inventors. The more formidable the problem the greater the satisfaction in encountering and overcoming it. "Impossible?" said Napoleon, "never repeat to me that blockhead of a word."

THE WAY WEALTH IS DISTRIBUTED.

We have seen that wealth is produced by the joint action of labor and capital; or, rather, by labor using capital as tools to work with. A man might raise a certain amount of corn with his naked hands, tearing up the earth with his fingers, and keeping it clear of weeds with the same means. But how much more he could raise by the aid of a simple hoe! He could produce more still by the use of a horse and plow, and still more with carts and all the modern implements of husbandry. All capital, from a hoe or ax up to the most elaborate manufactory, may be properly regarded as tools in the hands of industry, increasing its product of wealth.

Now, when the capital belongs to the laborer, as is the case with many of our small farmers, there is no division to be made of the product. The laborer and capitalist being the same man, the whole of the product belongs to him. But it sometimes happens that a man owns a farm, stock, utensils, &c., and does not desire to work himself, while another man is desirous of earning something by his labor, and an arrangement is made between them by which one man works with the other's capital, and the product is divided between the two; the proportion which each shall receive depending upon the relative supply of labor and capital in the market.

In other cases an arrangement is made by which the capitalist pays the laborer a specified sum for the season, or month, or week, or day, assuming the whole direction of the labor, and taking the risks himself of making it productive.

The amount which the laborer and capitalist shall receive depends, first, upon the aggregate amount of the product to be divided between the two; and this depends principally upon three things; first, upon the natural resources of the country in which the labor is performed; secondly, upon the skill with which the labor is directed; and, thirdly, upon the supply and quality of the tools with which the work is performed, in other words, upon the abundance of capital.

The influence of the natural resources of the country upon wages and interest was strikingly shown in California, soon after the discovery of the gold. Here was a region, 100 miles wide and 1,000 miles long, in which most of the beds and banks of the streams were filled with a very precious metal; the laborers were few and the capital was very limited; the result was that the product of labor, working even with the imperfect means furnished by the limited capital, was so great that there was a large amount to be divided between the two, and wages were from eight to twelve dollars per day, while capital was worth ten per cent and upwards per month. This was seen in the large amount paid for the use of all kinds of property which could be made available in facilitating operations, as well as in the high rate of interest on money. For instance, a rocker for washing out gold that cost thirty dollars would rent for a dollar and a half a day. The writer of this was in a log cabin in the mountains which rented for one hundred and fifty dollars per month; and after interest had been falling for three years, he, with his partner, loaned a drayman $2,500, to buy horses and drays with, at five per cent a month; and the man, besides paying the interest, cleared the whole amount in the course of one year, being worth that much more than he would have been if he had not obtained the loan. On the other hand, in Greenland the resources of the country are so few that the aggregate product must be small; consequently, while wages are low, no considerable amount of capital could be employed except at a very small revenue.

It requires a great deal of reflection and observation to enable one to appreciate fully the importance of a wise direction of labor in its effect upon the amount of wealth which it will produce. The writer of this noticed once in the suburbs of Acapulco, in Mexico, two blocks of logwood which had been hewn into shape to fit the back of a mule, in order to be thus transported over the mountains. Compare this mode of transportation with that upon our rivers, canals and railroads, and how small is the result of a day's labor in the one case contrasted with that in the other. German mechanics generally live and labor from one to three miles from the towns where they procure their work, and a large portion of their time is expended in transporting their mateial between their villages and the town. When the fruit of their labor, thus unwisely directed, passes into the market of the world, it amounts to so little that it will only pay them from thirty to forty cents per day.

Last, but not least, in its effect upon the product of labor, is the abundance of the tools or capital to work with. A man with a turning lathe can make more balusters than he can with a jack-knife; a man with a steam engine and a Woodworth planer can smooth more boards than he can with a jack-plane; a man with half a dozen great ships can transport more merchandise than he can with a yawl boat; a man with a large manufactory can make more cloth than he can with a spinning wheel and hand loom; and a nation with 30,000 miles of railroad can distribute more goods than it can with a few hundred pack mules. England, from the extent of her manufactories, from the number of her steam engines, from the abundance of all her appliances for aiding the operations of industry, in a word, from her great supply of capital, doubtless produces more wealth annually, in proportion to her population, than any other nation that ever existed. Next to England, in this respect, is the United States; and this country, from the great extent of its natural resources, and its rapid accumulation of capital, will, in all probability, surpass England in the production of wealth. Our annual production, in proportion to the population, is now many fold greater than it was forty years ago; this is shown, not only in the multiplied wages of our laborers, but still more in the enormously augmented revenues of our manufacturers, merchants and other business men.

Defecation of Sacharine Juices, and Complete Saturation of the Disinfecting Agent.

BY MESSRS. WORMS DE ROMILLY AND MARGUERITTE.

[Translated literally from L'Invention.]

Lime, in the manufacture of sugar, is at the present time exclusively employed as an agent for defecation. The moderate price of this substance, its precipitating action on extractive matters, and its perfect freedom from any injurious effect on the sugar, fully justify this preference. By the side of these precious advantages, however, lime presents the grave inconvenience of dissolving in considerable quantity in the sacharine juice, forming an uncrystallizable sacharate of lime, which, by the viscosity which it gives to the liquor, prevents also the crystallization of a quantity more or less considerable of the free sugar. Furthermore, if the excess of lime prevents the sugar from altering, it determines, under the influence of ebullition, and of the temperature which rises with the concentration of the juice, the formation and the coloration of viscous and deliquescent matters, constituting the greater part of the molasses which impregnates the brown sugar. In the manufacture of sugar, as well as in the refining, it was then very important to get rid of the excess of lime, and to be able to evaporate and cook the juice perfectly neutral.

Manufacturers employ animal black to discolor their juice, recognizing, also, that this agent of discolorization has the property of saturating and retaining the lime; and that the liquor was was discolored the better the less it contained of alkali. Animal black is then employed in this aim; but in certain years, and always towards the end of the manufacture, there is necessary for the defecation a proportion of lime such that to saturate the excess of it, enormous quantities of animal black are required. This plan is then ruinous. Divers processes have been proposed for the saturation of the excess of lime; but the most part have not been employed, either in consequence of the prices of the substances, of their destructive action on the sugar, or of the complications which they introduce into the operations, which ought, before all things, to remain simple and rapid. A single process, that of Mr. Rousseau, has received an industrial application; it consists in the passage through the alkaline liquor of an excess of carbonic acid; it requires the employment of a special apparatus which is quite costly, and it prolongs the time required in the operations.

The means proposed by us depend on very neat chemical reactions, of easy execution, and which require only an insignificant expense.

The result of the operation is to saturate the defecating agent in the state of sulphate or of carbonate, and that by reactions new, or at least different from those heretofore employed in this aim. Here are the divers manners in which we operate.

1. Make the defecation of the sacharine juice in the ordinary manner, by means of lime. To the racked liquor add flour of sulphur, or, better still, a small quantity of the persulphuret of calcium, which transforms instantly the excess of lime into the sulphuret. Next, pass the juice through a filter inclosing some subsulphate of the sesquioxyd of iron mixed with black or other dividing matter. At the contact of the subsulphate of the sesquioxyd of iron, the sulphuret of calcium transforms itself completely into the sulphate, and the lime thus becomes saturated. The juice, absolutely neutral, passes through the black and is afterwards submitted to the cooking.

2. To simplify the operation still further, it was natural to seek if the sulphuret of calcium, derived from the calcination of the sulphate of lime with charcoal, would not defecate the sacharine juice as well as caustic lime. Numerous essays have demonstrated that the defecation with the sulphuret of calcium is as rapid and as complete. As, however, the monosulphuret boiled with a large quantity of water may give the oxysulphuret, it is better, more for security, to boil the monosulphuret with a little flour of sulphur, in order to have a polysulphuret which will not alter. It is to be remarked though that the process may be applied, still preserving the ordinary defecation with lime, by adding, as is said above, liquid persulphuret. In the place of the sulphuret of calcium, there may be employed for the defecation the sulphuret of baryum derived from the calcination of the sulphate of baryta with charcoal. The racked liquor is filtered, as in the preceding operation, through a filter charged with the sesquioxyd of iron, and the baryta is completely precipitated in the state of sulphate. This reaction is most perfectly neat, and the absolute insolubility of the sulphate of baryta responds to all the objections which might be made against the employment of the sulphuret of baryum.

3. It was evident, since the sulphurets of calcium and of baryum are transformed into sulphates in contact with the subcarbonate of iron, that they would become carbonates in presence of any metallic carbonates capable of giving sulphurets, such as the carbonates of iron, of zinc, of manganese, &c. We cite these especially as being less dear to prepare artificially or to find in the natural state. In effect, the sulphurets of calcium and of baryum, put in contact with the carbonates of iron, of zinc, and of manganese, give carbonates of lime and baryta, and the corresponding sulphurets. The saccharine juice, defecated by lime, and consequently alkaline, being boiled with carbonate of iron, of zinc, or of manganese, gives carbonate of lime and oxyd of manganese, which appears to form a subcarbonate. But it is preferable to employ the carbonate of zinc or of manganese, the carbonate of iron being sensibly soluble in water.

4. Finally, the saccharine juice may be defecated by means of the alkaline sulphurets of potassium or of sodium, and passed afterward through a filter of the sesquioxyd of iron, which transforms the excess of the sulphuret into a sulphate of soda; this sulphate, although soluble, not preventing the crystallization of the sugar.

A BIG CASTING.—Messrs. Neilson, of Glasgow, have lately cast a sole plate for one of Randolph & Co.'s marine engines. The casting is twenty-one feet eight inches long, twenty feet wide, and eight feet high, and weighs fifty-nine tuns (of 2,240 lbs.). It was cast in a pit outside of the foundry. It is one of the largest castings ever made.

India-Rubber Manufactures.

On page 169, Vol. I. (new series), of the SCIENTIFIC AMERICAN, we published an illustrated description of the history and manufacture of American vulcanized india-rubber fabrics, which was admired by all who read it, and which contained information on the subject not to be found in any other publication. In order to render our pages replete with all useful information on this topic, we copy the following, respecting india-rubber manufacture in England, from the London *Mechanics' Magazine*:—

The very rapid and extraordinary strides which have been made in the manufacture and applications of caoutchouc or india-rubber, during the last thirty years—more particularly since the discovery and introduction of vulcanization—induces us to devote some space to a slight sketch of its past history, its present state, and its probable future.

With the exception of gutta-percha—a somewhat similar, though inferior gum—we know of no material that has wrought so many changes in so short a time, or one that, originally found wanting in its chemical components to withstand the action of the atmosphere, has, by the aid of chemistry, been so thoroughly "changed" that it has become one of our most valuable articles of commerce; the annual importation of various kinds of the raw material exceeding at the present time over 2,000 tons per annum, the price varying from 10d. to 3s. per pound.

The india-rubber tree from which the gum is obtained is a native of India and the Brazils; the product of Para in the latter country being very far superior to any other. Large quantities, however, are imported from Java, Penang, Singapore, and Assam, and these, though inferior in quality, enter largely into india-rubber manufactures.

The Para gum is obtained chiefly from the "Siphonia elastica," a species of seringa—by which name indeed it is commonly known by the natives—which grows in great luxuriance through all the forests in the Brazils. The trees, rising from eighty to one hundred feet, are bare to the hight of thirty or forty feet from the ground, when they branch out in a dense glossy foliage, the leaves, about five inches in length, much resembling those of the chestnut. The "Ficus elastica," a species of fig-tree which yields the Java gum, also reaches a very great size, one mentioned by Mr. W. Griffith being one hundred feet high, seventy-four feet in circumference, and the girth of the main trunk, along with the support immediately around it, one hundred and twenty feet. The area covered by the expanded branches had a circumference of six hundred and ten feet. In the Forest of Ferosepoor alone, in the district of Chardwan in Assam, an accurate survey resulted in the counting of forty-three thousand two hundred and forty such trees within a space of eight miles by thirty. The supply would, therefore, seem to be almost unlimited, though it has recently fallen short of the demand in the market, owing to its increasing use in various manufactures in England, as well as on the Continent and in the United States. We think, however, we may safely state that this scarcity is only temporary, and that as demand increases, so fresh forests will be opened up, and that demand adequately supplied. In confirmation of this view we have only to say that it has been ascertained that there exists a belt of forest trees extending ten degrees on each side the equator around the globe, which yield gums of this and a like nature.

The process of gathering the gum is rude in the extreme, and is capable of great improvement—a fact of which our manufacturers are now becoming fully aware. It is received in rude vessels of clay attached to the bark of the tree, in which incisions are made, and from which the gum in the form of a pure white milk-like juice exudes. These incisions rarely exceed four to each tree; the quantity obtained varying according to the size of the tree, about a quart being the product of each opening in the twenty-four hours. These incisions, however, are made separately, the first being at the greatest height from the ground, and when that is exhausted, another vein, if such a term may be used, is opened, and the tree is thus bled till its veins are dry. And there is more truth in this simile than would at first appear, the effect being so weakening that a tree cannot be tapped again for two years, that time being required to recover its wasted powers. The milk thus collected being placed in a large pan, forms or shapes made of clay or wood are dipped into it, and to these the gum adheres. They are then exposed to the smoke of a fire kindled with a peculiar nut, the Inaja or Urucari, which throws out a thick oily smoke of a highly drying nature. The dipping and drying is repeated till a sufficient number of coats are obtained on the moulds to give the required thickness. If a piece of bottle rubber be examined it will be found to consist of thin films (the result of this process), which may be separated layer from layer. In this clumsy manner large quantities are allowed to fall to the ground, where the gum becomes mixed with all kinds of dirt, deteriorating the quality of what otherwise would be equal to the best gum.

India-rubber was first brought to Europe, it is supposed, by some French travelers, on their return from South America, in the year 1730, and in the year 1736 M. de la Condamine read a paper before the French Academy, on its wonderful properties, describing the tree from which it was obtained, and the mode of preparation. More recently we find it mentioned in our own country by Dr. Priestley in his introduction to "The Theory of Perspective," A. D. 1770; wherein he speaks of it as newly introduced, and praises its qualities for removing pencil marks from paper, adding that "the vendor of it is Mr. Nairre, instrument maker, opposite the Royal Exchange, where it can be bought in cubical pieces of half an inch for three shillings sterling!"

How little was then foreseen of its valuable properties; and, indeed, how many of the present generation remember it as only used in their school-days for *rubbing out mistakes*, or for the clandestine amusement of "chewing"—the latter foreshadowing the present plan of "mastication" which it undergoes in the process of manufacture.

From 1770 to 1791 nothing seems to have been done with the new material, though attention had been drawn to its wonderful power of elasticity and its resistance to wet. The grand difficulty, however, was to find a solvent for it of such a nature that it might be easily manipulated. In 1791 the first patent for effecting this was taken out by Samuel Peal, who claimed an "improved method of making waterproof all kinds of leather, cloth, &c.;" which he accomplished by "dissolving by distillation or infusion over a brisk fire" india-rubber in spirits of turpentine, and then "spreading it on his cloth or other material by the aid of a *brush*," &c.! Here is the germ of our present waterproof coat, for which Samuel Peal deserves a nation's thanks—peace to his manes.

During the next thirty years, though little was done in the way of advancement, the wonderful properties of the material had attracted the attention of several ingenious and inventive minds, who gave their whole time to its study. Chief among these stand out the names of Thomas Hancock in England, and Charles Goodyear, in America, who were veritably, by their indomitable perseverance, the originators and perfectors of the present india-rubber trade. In 1820 a patent was taken out by Mr. Hancock for the application of gum elastic to springs for trowsers, gloves, shoes, &c., which to the present day, though in a much improved form, are amongst its most valuable uses.

In 1823 another step was taken by the patenting, by Charles Macintosh, of the well-known waterproof garments which bear his name. These were advances in the right derection, valuable in their way but yet far short of perfection.

One of the largest articles of consumption in the early days of india-rubber was the overshoe or galoshe—not the elegant *slipper* which we now have, but a clumsy piece of native manufacture. These shoes, made by the Indians on the banks of the Amazon, and simply formed on wood lasts, coated by repeated dippings and smokings—as followed in the making of the bottle-rubber before described—were introduced into the United States about the year 1820, and for many years the imports reached the large number of five hundred thousand pairs per annum.

At this time there was a perfect furor in America for india-rubber manufactures, and almost incredible sums were invested in machinery and buildings in various parts of the country for making overshoes and waterproof goods generally. This reached its height in the year 1834-35, when, to the dismay of all interested, it was found that the gum, after passing through the process of manufacture, would not withstand the action of the atmosphere, and all the goods they had made were running away in the form of treacle, or stuck together past all sundering. This was such a blow as would have destroyed any other business; but the elasticity of the article was not to be thus restrained; it was destined to rise again and rebound to higher elevations than it had yet reached. Here was a field for genius, and the man to seize the opportunity was Charles Goodyear, who, by indomitable courage, unwearying study, and the endurance of privations such as fall to the lot of few men, at last discovered a means to overcome this decomposition, and make india-rubber what it now is.

[To be continued].

The Chrome Mines of Chester County, Pa.

A correspondent of the *West Chester Jeffersonian*, writing from Hopewell Borough, thus describes the Chrome Works in that vicinity:—Some six miles southwest of this place lie the famous chrome mines, familiarly known as "Wood's Chrome Banks." They and a tract of land are owned by a Mr. Tyson, of Baltimore, Md., properly styled the "Chrome King." To these quarries or mines we paid a visit during the last season, when there were upwards of 70 hands employed in and about the mines, independent of those engaged in hauling the chrome to market. There are two shafts sunk, from which the ore or mineral is taken. They have descended to the amazing depth of three hundred feet. The mouths of the shafts have nothing dissimilar in their appearance to that of an ordinary well, probably a little wider. They descend perpendicularly some 75 feet, then strike off in an oblique direction for a distance, then perpendicularly again, and so on to the bottom of the pits, the men being, as we are told, some fifty yards further south at the bottom than at the entrance. The chrome is drawn up by mule power. Two buckets about the size of a flour barrel are attached to a rope at each end. While one is being emptied the other is being filled. Some 300 yards distant is the mill for grinding the chrome preparatory to barrelling it. Here they have a water-power excelled by few, having the advantage of all the water of the "Octoraro Creek," if needed. From here there is a shaft runs (connected by machinery to the mill) to the mines, and there attached to pumps for the purpose of pumping the water from the pits. Strangers are at liberty to descend into the pits, having a torch and a man to lead the way for them; but the "trip" down is a dangerous one, requiring care and caution, as the rounds of the ladder are continually wet and slippery. Owing to the continual drippings, it is a most beautiful place to get a suit of clothes spoiled, and those desiring to see the wonders of underground work had better prepare themselves with an oil-cloth suit. The magnitude of the business done here cannot be well comprehended by the mere reading of a meager description of it. This is said to be the richest vein in the known world.

Chrome ore is composed of the oxyd of iron and chromic acid. This is the acid, of all the salts called "chromates," that are now very extensively used in the arts. Chromic acid possesses the remarkable property of igniting ether when brought into contact with it; and some method may yet be employed for using it in the manufacture of igniting compounds as a substitute for phosphorus and the chlorate of potassa. Chromic acid combined with potash is the most common form in which it is used in the arts. In this relationship it is called the bichromate of potash; its color is a deep orange, and in form it is a beautiful crystalline salt. It is used as a mordant for coloring black on wool, and for making black ink when combined with logwood; it colors orange and yellow on cotton goods, and the oxyd of chrome is a common green pigment employed in lithographic, copperplate and steel plate printing. Its green color is very permanent, and this quality renders it well adapted for printing bank notes for which purpose it is now much used. The oxyd of chromium when reduced to fine powder is one of the best reducing and polishing substances for metals known, and which we think is even superior to the finest emery for polishing steel. The best irridium pointed gold pens become useless when used for writing signatures for a few hours over the green chrome ink that is printed on bank bills.

THE PATENT LAWS.—The bill to amend the Patent Laws, which passed the Senate at its last session, has not yet been taken up in the House. There is no probability that it will receive attention at this session. Members of Congress have their hands full to arrange a basis of settlement of our political difficulties, and the term of the present Congress is limited to the 4th of March.

THE mechanics of Louisville, Ky., of which there is a noble band in that city, recently met in convention to consider the political condition of our country, and have sent forth an address to their brother mechanics of every State, full of patriotic and fraternal sentiments, calling upon them to lay aside all partizan prejudices and to come forward and make an earnest effort to "throw oil upon the troubled waters."

THE POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

[Reported for the Scientific American.]

The usual weekly meeting of the Polytechnic Association was held, at its room in the Cooper Institute, this city, on Thursday evening, Jan. 10, 1860. The President, Professor Mason, in the chair.

The PRESIDENT proposed as a subject for future consideration, "The Effect of Temperature and the Force Operating in Crystallization."

Mr. HASKELL proposed, "Artificial Members of the Body."

Mr. STETSON proposed, "Compressed Air and its use in Propulsion."

IMPROVED MAGNETIC TELEGRAPH.

Mr. HOLCOMB exhibited and explained his improvements in the apparatus for telegraphing. He introduces a permanent magnet in such a way as to induce magnetism in the soft iron core of an electro-magnet, so that in passing in one direction it adds its power to, and in passing in the other direction it subtracts its power from, the magnetism induced by the battery. He is thus enabled, by one movement of the key, to combine the two powers, and consequently to produce a signal with a current so weak that with the ordinary electro-magnet it would be impossible to produce any signal whatever. When the spring is once adjusted, there is no difference between a strong and a weak current, so that it requires no further adjustment. The improvements embrace this use of a permanent magnet, an improved spring for adjustment, and an improved method of producing signals by sound.

Mr. DIBBEN inquired if there were two motions of the finger in producing the signal.

Mr. HOLCOMB—It is by breaking and connecting; it is one motion of the finger.

Mr. STETSON—Can you telegraph farther and faster with this?

Mr. HOLCOMB—That should be the result; both farther and faster. I have a patent, not for the continuation of a permanent magnet, but for securing the current in producing a single signal.

Mr. DIBBEN—Using two signals to make one?

Mr. HOLCOMB—Yes, sir; theoretically there are two motions, practically, one.

Mr. SEELY—There is certainly novelty here, and if the gentleman's position is correct, he has made a very valuable discovery. With the means we have heretofore used, we get twice as much available power as heretofore. With the battery, we get a certain power, and with the common magnet a certain power; and these may both be weighed. By the combination you increase the effectiveness without increasing the cost. I have seen the experiments by which Mr. Holcomb, in part, thinks he demonstrates it. The experiments lean towards that conclusion; but they are not without objection. Mr. Holcomb feels quite sure that his discovery is genuine, and I understand him to come here to invite experts in magnetism and electricity to examine his evidences and refute him if he is wrong. The manipulation of the key is precisely the same as of the ordinary key; but at each movement of the key you break the current, reverse it, and restore it. Pressing the key the current is broken; pressing it further it is reversed, and releasing it the current is restored.

BUTTON-HOLE SEWING MACHINE.

Mr. TOWSLEY exhibited Vogel's Button-Hole Sewing Machine (noticed on a former evening) and specimens of its work, and explained its operation. It makes six different stitches, and is constructed with such simplicity that a novice may learn in a short time to work the machine with perfect facility. Button-holes can be worked with perfect ease at the rate of 100 per hour. Some of the specimens make the stitch somewhat open, but the stitch may be regulated as in other machines, so that it shall be as close as handwork. The machine can be worked with two, three, four, or five separate threads. In working a button-hole we may carry a cord upon the upper side, or upon the lower, and work over it, and work with the same rapidity that we work without carrying the cord. He regarded the buttonhole stitch itself far superior to that made by hand, for the reason that it is almost as elastic as any goods it is put upon. With the identical machine exhibited, any class of goods could be sewed, from the finest fabrics to harness leather. The machine makes two different kinds of buttonholes: one of which would be pronounced by a tailor to be a French buttonhole worked by hand. By the addition of another thread a buttonhole is produced which is finished upon both sides of the goods.

The PRESIDENT—Have you considered the question of making the buttonhole stronger at the point where it passes the button?

Mr. TOWSLEY—We have; and you will see that as we pass round the corner that the machine is so constructed that it brings one stitch a little back of the other, and brings them closer together, and works upon both sides.

The PRESIDENT (examining the stitch)—That looks very much like "doing the sum."

Mr. TOWSLEY explained the change which might be made in the character of the stitch merely by changing the tension of one of the threads. The machine differs *in toto* from other machines. It makes four different embroidery stitches. By a simple change of one of the tension screws, instead of putting a cord, it puts a binding upon the edge of the cloth. This cord or this binding will outwear those put on by hand. The machines are sold as low as other first-class machines. It makes but little noise. The treadle and the feed are different from those of other machines. The treadle allows a single stitch to be made and the machine to be started again without touching the balance wheel; and the feed carries both pieces of cloth along equally. One of the stitches closely resembles the Grover & Baker stitch, and another the shuttle stitch. Another advantage, in keeping in repair, is that there is no part of the machine which will wear rapidly.

POTTERY.

It had been announced that Dr. Davis would read a paper upon this subject; but he was not present.

The PRESIDENT made some remarks upon the universal diffusion of clay upon the surface of the earth, and upon its strong affinity for silica, so that a large proportion in potter's ware is silica. It was noteworthy that clay, while the most easily used in the arts, pottery being one of the earliest inventions of savage tribes, and clay burned or dried in the sun being an early building material, contains within it a metal for which the developments of the present day seem to prophecy a usefulness in advanced civilization above that of most if not all other metals.

Mr. JOHNSON exhibited some specimens of images from Siam, and also specimens of Minton's encaustic tiles.

Mr. ROUSE, a practical manufacturer of Jersey City, said that all the materials, except flint, can be had, as good in this country as in Europe. In crockery ware, out of 32 parts, 22 parts are the blue-ball clay, or Jersey clay, or common white clay. This comes, a large part of it, from Woodbridge, near Perth Amboy, N. J. Most of our table ware is imported, not more than one-thousandth part being made in this country. And it has been but a few years since the American manufacture has been successful. But now that flint and borax are admitted duty-free, we can compete successfully with Staffordshire. The flint is imported, ground, at less than a cent per pound; whereas they could not grind it in this country at less than two cents. The cost of transportation from Staffordshire to Liverpool, and then from Liverpool to New York, the former being greater than the latter, was such that we could undersell the imported ware. Every manufacturer has his own secret in mixing the materials, and more particularly in the glazing. Thousands of dollars are sometimes lost from an improper proportion. For instance, if one of the materials is not ground so finely as another, when they are passed through the lawn, or bolting cloth, an undue proportion of it may be excluded, and thus spoil the whole batch. It cannot be detected until the work is finished; when it may all fly to pieces in glazing.

Dr. STEPHENS said that the clay used in the manufacture of earthen ware is an oxyd of aluminum, and contains a considerable portion of silex, and often of lime and potash. If it contains too much potash, it will run or fuse. Most of the clays found in the carboniferous regions of the United States are of that character. The clays found in this neighborhood are confined to the cretaceous or chalk formation, beginning at Martha's Vineyard, and extending southward to Texas, and northward to the Arctic ocean. The clays of the Pacific ocean belong to the testiary period. Kaolin, or porcelain clay, is derived from the immediate decomposition of granite rocks, containing 'ls-par, which is an oxyd of aluminum, and probably was once a clay. One of the greatest difficulties is to obtain a clay free from sulphate or sulphuret of iron. At Woodbridge, beneath the pottery clays, are large beds of sunken trees, which are so thickly saturated with the sulphate or sulphuret of iron, that, when exposed to the atmosphere, they are at once coated over with copperas. The further you rise above these trees, the less iron is contained in the clays.

The PRESIDENT remarked that the coloring matter in these clays was supposed to be due to the presence of infusion, which are burned out in the manufacture of the ware, leaving the ware white.

Mr. ROUSE remarked that all the porous cups used in the United States and in Canada for batteries, are manufactured in Jersey City.

Mr. BARTLETT referred to the establishment at Sevres, in France, under government patronage, which produces new models in the highest style of art, and distributes them free to all the manufacturers in France.

The PRESIDENT expressed the opinion that at least a million dollars had been utterly wasted in this country from scientific ignorance in the manufacture of earthenware. Science ought to determine the proportions of the materials, so that no such losses as those described by Mr. Rouse should occur. The city of New York ought to be provided with a laboratory, where, at least, three or four young men should be devoted wholly to scientific original investigation, to publish their results for the benefit of the world. The President proceeded to make some incidental remarks upon the tendency of population to increase upon the seaboard, where the metals meet the coal and both meet the ocean.

A gentleman from Pennsylvania gave some statistics to the same effect.

Dr. STEPHENS made a few remarks upon ancient pottery. The ancient potteries found in the United States were made by tribes of Indians driven out of the country before its discovery by Europeans, of whom the only representatives now are the Puebla Indians of Mexico, which are white, and entirely distinct from the copper-colored Indians. They did not possess the art of glazing; but they had much taste, and produced ware which was highly ornamental.

Mr. JOHNSON desired that Dr. Davis should have an opportunity, at the next meeting, to read his paper upon pottery.

Mr. SEELY was prepared to make some remarks upon the chemical aspects of the subject.

The subject of pottery was continued for discussion at the next meeting.

Mr. HEDRICK suggested that glass should be considered in the same connection, especially in the chemical consideration.

On motion, the meeting adjourned.

THE *Valley Farmer*, a monthly journal of agricultural, horticultural and rural affairs, published in St. Louis and Louisville, in speaking of the SCIENTIFIC AMERICAN, says:—"We need only remind those who are not familiar with the high character of this work (and who that is engaged in any scientific or mechanical pursuit is not?), that there is no work in the English language, or indeed in any other, superior to it in merit. It occupies the whole field of scientific and mechanical discovery and invention, and is the firm friend of American inventors. The conductors, through their patent agency, do more in securing patents on new inventions, both in this country and in Europe, than all others engaged in the business." This is certainly most kind, and if we mistake not, we discover in it the partiality of our genial friend, Mr. Byram, who is associated with Mr. Coleman in the editorial management of the *Valley Farmer*.

COAL OIL LAMPS.—The common lamps for burning this oil are furnished with a hollow wick cone, perforated at the bottom to admit a current of air to the flame. It is ordinarily placed above or on a level with the wick tube, and obscures a portion of the light. A patent has been issued in England to J. Hinks for placing a conical deflector below the top of the wick tube, so as to make the air impinge on the flame at about the top surface of the wick tube; the latter is also made in two parts, joined by a perforated collar, which admits air up the central part of the wick of the lamp. It is stated that a more brilliant flame is obtained by this arrangement.

Recent American Inventions.

The following inventions are among the most useful improvements lately patented:

HOISTING DEVICE.

The object of this invention is to obtain a powerful, and, at the same time, a simple and compact hoisting device capable of general application, but more especially adapted to the lifting or hoisting of heavy weights. The invention consists in the use of two pulleys of different diameters, and an endless chain, band or rope applied to the pulleys, and so arranged as to effect the desired result. This invention may be used for lifting loads through short spaces, and may be inclosed in a block casing, similar to the usual lifting jack, and the implement is rendered capable of being connected to any windlass or hoistgin, for the purpose of increasing the power of the same. John J. Doyle, of New York City, is the inventor.

STOPPING AND STARTING RAILROAD CARS.

This invention, by James Higgin, of Manchester, England, does away with the use of brakes. The wheels of the cars are made without flanges, and of a great diameter ; the bodies of the cars are only about four inches above the rails ; the parts of the cars immediately above the rails are provided with plates of iron, with projecting flanges at one or more parts fitting within the rails, such projecting flanges serving the purpose of the flanges now used on the wheels. When it is desired to stop the train, the cars are lowered bodily, by means of shafts, wheels and screws, or other equivalent devices, to bring the plates above referred to on the rails. The locomotive, tender and cars are connected by shafts to suitable couplings, and the gearing for lowering the carriages on to the rails is brought within convenient reach of the engine driver and of the conductor or other appointed person on the train. The cars are lowered and raised clear of the rails by an auxiliary steam engine or other convenient machinery. In case an axle should break, or other accident occur to bring one of the cars suddenly to the rails, the apparatus for lowering the other cars is instantly and automatically brought into operation by means of a spring or friction apparatus, which is acted upon by the increased friction produced. The said spring or friction apparatus may also be in connection with the starting lever of the locomotive, to shut off the steam at the same time.

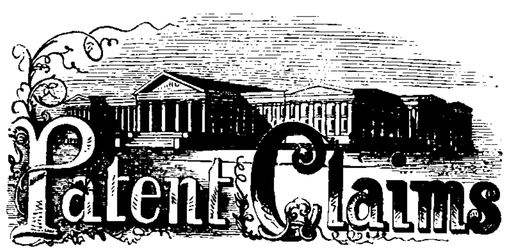
Report of the American Institute on Emery Vulcanite.

We have before alluded to this new and useful article of manufacture, made and sold by the New York Belting and Packing Company, in this city. We have used it for several months for sharpening dining knives, and we cannot too highly accord the preference to it over the steel for this purpose. Upon inquiry at the office of the manufacturers, we learn that they are receiving orders from cutlery and edged tool makers for large quantities of the vulcanite, who ordered but little at first for trial. At the last meeting of the American Institute, the Committee on Manufactures, Arts and Sciences made the following report:—

That the committee have examined the emery vulcanite, with a view to compare it with other abraiding substances used in the arts, particularly in the arts where metals are operated upon, and they have found it to possess some important properties which render it superior to the other substances employed for wheels, grinding and polishing finishing files, scythe rifles, and other like articles. The substance consists of india-rubber mixed with emery powder, of any desired degree of fineness, the whole mass being vulcanized at a high temperature in molds which impart the desired form to the articles. The peculiar properties which the composition possesses are due to the india-rubber.

Wheels and whetstones have long been made of emery powder held together by glue, shellac, rosin, burned clay, &c., &c., but they were found to be brittle, to be liable to get out of shape, and to possess little advantage over native stone. Emery vulcanite, on the contrary, is tough, and whenever a wheel is worn "out of true," it can be faced to any *contour* in a lathe by using a hot iron and a shape as a turning tool. Table steels, finishing files, rifles, &c., &c., are made in this substance of any shape, and they possess the important property of being effective when nearly worn out as they were the first day of their use.

REGARD FOR BUTTONS.—The Earl of Westminster, the richest peer of England, having an income of three million dollars a year, recently, while riding in one of his parks, missed a button from his coat. He instantly dismounted, and retraced his course for some distance, and searched until he found the missing article, expressing much satisfaction at its discovery. He must have had a very strong attachment to his button.



ISSUED FROM THE UNITED STATES PATENT OFFICE

FOR THE WEEK ENDING JANUARY 8, 1861.

Reported Officially for the Scientific American.

*** Pamphlets giving full particulars of the mode of applying for patents, size of model required, and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, New York.

67.—E. B. Banker, of Schaghticoke, N. Y., for an Improvement in Railroad Chairs:

I claim the combination of wedge, J, with the divided or compound chair, the same consisting of the jaws, B B and B' B', extended base pieces, A A', with their inclined surfaces and the lapping and abutting lips, b b1 b2 b3, all arranged in the manner specified.

[This invention is a new and improved chair for connecting the ends of railroad rails, and for securing said rails at the joints, in a rigid and permanent manner on the cross-ties. It consists of two double-lapped half chairs united by a double-lapped joint, in combination with a transverse wedge which forces the lips of the rail base up against the halves of the chair, and at the same time rigidly binds together the two halves of the chair.]

68.—A. W. Brinkerhoff, of Upper Sandusky, Ohio, for an Improvement in Corn Planters:

I claim, first, The combination and arrangement of rods, d, cranks, e, and cylinders, b, with the sectional frame and axle, as set forth, whereby the exterior sections, may be turned up and the planting of the center section continued.

Second, The combination of opener and coverer, F, with the eye, m, brace, n, and bolt, k', constructed, arranged and operating substantially as set forth.

Third, The arrangement of the tongue, H, hounds, G, set screw, k, axle, c, and frame, A, as and for the purposes set forth.

69.—I. S. Brown, of Hopkinton, R. I., for an Improvement in Saw Teeth:

I claim the employment in saws of one or more planing teeth having a form substantially as described, that is to say, having a section at right angles to the line of motion of a form analogous to the letter, S, so as to present separate cutting surfaces for each side of the kerf, so nearly opposite as to support each other, and so arranged that each of the two cutting edges has a separate and independent passage for the escape of its chips, substantially as set forth.

70.—E. P. Carter, of China, N. Y., for an Improvement in Window Sashes:

I claim the combination of the sash, B, with the strip, C, constructed as described, the two being hinged or secured together by the plates or bars, a, a, and operating in the manner and for the purpose specified.

71.—Loring Coes and A. G. Coes, of Worcester, Mass., for an Improved Machine for Grinding Heads for Screw Wrenches:

We claim, in combination with grinding and polishing machines, a holder to which the articles to be ground are secured, said holder being so constructed and arranged as that the position of the articles may be changed while in said holder, for the purpose of grinding or polishing square or beveled faces, substantially in the manner described.

We also claim connecting the holder to which the article to be ground is secured to the lever, F, by means of a universal joint, substantially in the manner and for the purpose described.

We also claim, in combination with a holder suspended to a universal joint, as described, the adjustable lever, F, for the purpose of adapting the machine to the wear of the grindstones or to stones of different dimensions, substantially in the manner described.

We also claim, in combination with a grinding and polishing machine and with a holder as above described, the pattern plates, Figs. 7, 8, 9, or other equivalents, for the purpose of automatically grinding or polishing plates to different patterns, substantially as described.

72.—Wm. Combs, of Duquoin, Ill., for an Improvement in Corn Planters:

I claim the arrangement of the shaft g, with the sleigh, the ground, the hopper box, D, and the lever, F, in the relation described for the purpose specified.

73.—J. J. Doyle, of New York City, for an Improvement in Hoisting Devices:

I claim the employment or use of the pulleys, a b, placed on the same shaft, and having different diameters, in connection with the endless chain, B, or an equivalent rope or band, arranged and applied substantially as and for the purpose set forth.

I further claim, in connection with the pulleys, a b, and chain, B, or its equivalent, the pulley, e, and guide rollers, g g h, arranged in relation with the chain, B, to operate as and for the purpose set forth.

74.—J. H. Glover, of Glasgow, Ky., for an Improvement in Mill Gearing:

I claim, first, The auxiliary spur wheels, A A', in combination with the middle or main spur wheel, B, the arms, b b b b, set screws, i i i i, slots, g g g g, and clamping bolts, c, all arranged and made to operate substantially as and for the purposes set forth.

Second, The eyes, k k k k, diagonal brace rods, G G G G, with their turn buckles, in combination with the middle tie, H, and shaft, C, arranged as and for the purposes specified.

[This invention relates to certain novel improvements in gear or toothed wheels, and it is intended more especially for the large driving gear used in mills, for preventing the back lash which occurs in such wheels when the spaces between the teeth are increased, in consequence of wearing of the teeth of one wheel upon another. The invention also has for its object the employment of brace rods in conjunction with a central tie, arranged and combined with the spur wheel, in such manner that the spur wheel will be more securely confined to its shaft, and the shaft itself will be braced and strengthened against vibrations or trembling.]

75.—Isaac Griffin, of Milford, Ga., for an Improvement in Cotton Presses:

I claim the combination and arrangement of the screw, B, movable platform, E, arms, F, and pressing blocks, G, with boxes, H, as and for the purposes set forth and described.

76.—James Higgin, of Manchester, England, for an Improvement in Stopping and Starting Cars:

I claim the improved mode of retarding and stopping railway carriages shown and described, or any modification of the same, whereby the carriage is lowered on to the rails of the permanent way.

77.—W. B. Hix, of Rome, Ga., for an Improved Arrangement of Flues for Drying Tobacco:

I claim the employment, in the drying of tobacco, of a system of flues, B B' C, and chimney D, with dampers, E F F', arranged and operating together within a suitable inclosure, A, as and for the purposes shown and described.

[The object of this invention is to arrange a number of flues in a dry-house in such a way that, by being provided with suitable dampers, the heat may be equally distributed or directed from one part of the dry-house to another, as occasion may require, and the heat placed under the complete control of the attendant.]

78.—Wm. Hotine, of Brooklyn, N. Y., for an Improved Machine for Mixing Dough:

I claim the combination and arrangement of the feeding devices in hoppers, A B C, the face plate, I, the mixing devices and packer, L, in the trough, G, substantially as and for the purpose specified.

79.—James Ingram, of New York City, for an Improved Water Back for Cooking Ranges:

I claim, first, The movable water back, e, when sustained by the roller, 2 2, and actuated by the lever, h, and rod, i, as and for the purposes specified.

Second, I claim the arrangement of the movable plate, l, and finger, 8, relatively with the movable water back, e, for the purposes and as specified.

Third, I claim the hollow or faucet hinges, p p, combined with a movable water back, whereby the said water back can be turned toward or away from the fire without bending or springing the pipes, as set forth.

80.—John F. Killer, of Greencastle, Pa., for an Improvement in Machines for Sowing Fertilizers:

I claim, first, The arrangement of a series of spiked rollers, B, when placed vertically and moved through a partial revolution by a reciprocating motion, substantially as set forth.

Second, I claim the use of the clearers, H, and the feed slide, R (Figs. 5 and 6), provided with the peculiar openings, G, substantially in the manner and for the purposes described.

Third, I also claim the arrangement of the removable connecting rods, E and W, in combination with elbow, X, and the universal joint, substantially as described, for the purposes specified.

81.—E. W. Kimball, of Ottawa, Ill., for an Improvement in Corn Planters:

I claim the reciprocating seed slides, d d, and valves, I I, when the latter are operated by the projections, j, on the slides, d, and springs, i, on the rods, J, and the latter provided with indicators or rods, L, all arranged as and for the purpose set forth.

[This invention relates to an improvement in that class of corn planters in which the seed-distributing device is placed on a mounted frame and which are designed for planting in check rows. The invention consists in the use of a reciprocating seed slide, in connection with valves placed in the lower parts of the seed tubes and indicators connected to the valves, so that the seed is dropped near the surface of the ground, and the operation of the valves noted or indicated, so that the operator can instantly detect any failure in the dropping apparatus.]

82.—David Pardee, of Carlyle, Ill., for an Improvement in Seeding Machines:

I claim the arrangement of the perforated ratchet distributing wheel, H, cut-off brush, I, spring pawl, J, spout, F, coulter, E, and hopper, G, with the sliding bar, L, springs, K e, arm, g, cam, C, pivoted guides, f f, shaft, i, hook arm, M, and recess, j, all as shown and described.

[This invention consists in a novel and improved means employed for preventing the seed-distributing device from becoming choked or clogged, and thereby rendered inoperative, a contingency which frequently occurs in other machines.]

83.—J. C. Pease, of Sycamore, Ohio, for an Improvement in Field Rollers:

I claim the arrangement of rollers, R R' R'', swivel frame, f, shaft, S, braces, B B, strap, C, and tongue, T, as and for the purpose set forth.

84.—W. P. Penn, of Belleville, Ill., for an Improvement in Seeding Machines:

I claim the joint arrangement of the cleaning pins, a a a, the feeding wheel, E, the fender, F, and revolving cutter, C, in the manner described.

85.—W. B. Quarton, of Carlinville, Ill., for an Improvement in Seeding Machines:

I claim the arrangement of the rods, E', cutters, D, axle, D', oscillating shaft, D'', rod, h, lever, E, seed box, B, rollers, J, hub, e, and hinged pivoted lever, h, all as shown and described, for the purposes set forth.

[This invention consists of a number of wheels that are placed side by side on a fixed shaft, each of which will be capable of an independent motion of the cutters, and so constructed and placed on the shaft that they will rise or fall and accommodate themselves to the inequalities of the surface of the ground, independently of each other, while they will each form a deep and sloped furrow and corresponding ridge, and plant and press the seed completely into the soil.]

86.—Gelston Sanford, of New York City, for an Improvement in Horse-powers:

I claim the manner of arranging the frame, L, rim, J, and spider, K, with the bed frame, A, of the machine, for the purpose of revolving the frame, L, and belt pulley, so that the power can be applied to a shaft or shafts standing in different relations to the driving machine, as set forth and described.

87.—W. H. Saunders, of Hastings, N. Y., for an Improvement in Couplings for Connecting Thills to the Axles of Carriages:

I claim the combination of the centerpiece, strap, elastic tube and pin of the clip, substantially as specified, whereby the tension of the elastic tube causes the centerpiece and strap between which it is compressed to gripe and hold the bolt, or equivalent, by which they are secured to each other, as set forth.

88.—A. E. Smith, of Brouxville, N. Y., for an Improvement in Railroad Car Axles:

I claim the constructing of wrought iron or steel railroad axles by the arrangement of longitudinal ribs or bars of metal solidly united together at right angles to each other, somewhat in the form of a cross, in the manner and for the purposes set forth.

89.—B. C. Smith, of Burlington, N. J., for an Improved Mode of Constructing Iron Pavements:

I claim an iron pavement composed of a series of plates laid a given distance apart from each other, and having projections and recesses so proportioned to that distance that the plates, when undisturbed, may form an unyielding pavement, and that one of the plates may be readily removed after a slight lateral movement of the adjacent plates, as set forth.

90.—W. McK. Thorton, of Niles, Mich., for an Improved Machine for Creasing and Finishing Leather Straps:

I claim the combination of the unequal rollers, F and J, operated in the manner and for the purposes set forth.

91.—P. D. Van Hoesen, of New York City, for an Improved Sad Iron:

I claim a handle, B, for a sad iron which is provided with a shield, C, and which is attached to the iron by means of square pins, c c', and lugs, a a', and locked by a drop catch, D, in the manner and for the purpose set forth.

[This arrangement consists in the arrangement of a wooden handle, which can be attached to the body of the iron and taken off from the same by a simple contrivance, and which is provided with a protecting plate or shield, in such a manner that the handle can be brought down as close to the body of the iron as the thickness of the fingers and of said shield will allow without exposing the hand of the operator to the influence of the radiating heat.]

92.—Ellis Michael (assignor to Andrew Free and J. W. Free), of La Porte, Ind., for an Improvement in Grain Separators:

I claim the slats, i k k', placed respectively on the apron, E, screen, G', and chessboard, J, where said parts are arranged relatively with each other, the fan, D, and the screen, F, to operate as and for the purpose set forth.

[The object of this invention is to obtain a machine by which the grass seed may be separated from the grain before being subjected to the blast, and thereby render the latter more efficient in its operation than hitherto.]

93.—Purches Miles, of New Haven, Conn., assignor to Plant's Manufacturing Company, of Southington, Conn., for an Improved Meat Cutter:

I claim the combination of the rotary spiral forcing flanches, F, and grooves, h, with the revolving beaters, E, and stationary cutters, D, in the manner and for the purposes shown and described.

[The invention consists in the employment or use of a rotary conical cutter, provided with spiral knives, and placed within a conical shell which has within it spiral grooves of gradually decreasing width from the larger to the smaller end of the shell.]

94.—Purches Miles, of New Haven, Conn., assignor to Plant's Manufacturing Company, of Southington, Conn., for an Improved Cutting and Grinding Apparatus:

I claim the combination of the spiral knives, i j, and rotary cutter head, B, with the spiral grooves, e, and longitudinal grooves, h, of the concave, A, in the manner and for the purposes shown and described.

[This invention consists in the employment or use of a series of stationary cutters and revolving heaters or feeders placed on one and the same shaft, and within a suitable cave or shell, whereby a very efficient cutting apparatus is obtained, and one that may be regulated whenever desired, in order to always preserve a proper cutting action similar to that produced by ordinary shears.]

RE-ISSUES.

13.—M. R. Flanders, of Parishville, N. Y., for an Improvement in Grain Cradles. Patented June 28, 1859:

I claim attaching the finger standard, B, to the snath, A, by means of the rod, C, and eye, b, secured respectively to the standard and snath, in connection with the compensating or adjustable braces, H J, the whole being constructed and arranged substantially as and for the purpose set forth.

I further claim the compensating or adjustable braces or stays that connect the figers, F, and which are formed of the rods, e e, and socket, G, when said rods are connected to the fingers, F, by the collars, a, substantially as set forth.

[This invention consists in a novel mode of attaching the finger standard to the snath and bracing the fingers, and also connecting the fingers together, whereby the several parts are rendered capable of being readily adjusted to suit the operator or as occasion may require, and a very strong and durable implement obtained.]

14.—Elliot Dickerman, of Richmond, Vt., for an Improved Clothes-wringer. Patented April 10, 1860:

I claim, in machines for drying clothes by compression between rollers, employing, as one or both of the rollers for acting upon the clothes, a rubber coated or equivalent elastic and non-absorbant roller, A, so mounted in a suitable framing, B B, that the compression of the elastic material on that side which is acting upon the clothes is attached by a corresponding compression of the elastic material against a roller, D or E, on its opposite side, as and for the purpose set forth.

15.—J. A. Vaughn, of Cuyahoga Falls, Ohio, for an Improvement in Grain Separators. Patented April 24, 1860:

I claim, first, in combination with a series of zigzag screens and directing boards, having a shake motion, the stationary chambers for receiving the material therefrom, substantially as described.

Second, I claim the combination of the series of zigzag screens and directing boards, having a shake motion, the stationary receiving chambers and short fan, when arranged to operate substantially as described.

Third, I claim the combination of the directing board, P, cockle riddle, Q, and cockle board, R, substantially as and for the purpose described.

16.—Jasper Johnson, of Genesee, N. Y., for an Improved Gate. Patented March 6, 1860:

I claim operating a gate upon its hinges by the alternate partial rotation of a bent rod or bar, one branch of which moves between guides on the face of the gate, the other branch being inserted into the supporting post, said partial rotation being effected by the devices described, or their equivalents.

17.—J. W. Moffitt, of Harrisburg, Pa., for an Improvement in the Manufacture of Porcelain Teeth. Patented Nov. 20, 1860:

I claim the manufacture of porcelain teeth and gums of the material specified, in the proportions described and set forth; the same being prepared, applied and consolidated together upon the plate, substantially in the manner described and for the purpose specified.

18.—E. H. Graham, of Manchester, N. H., formerly of Biddeford, for an Improvement in Magazine Guns. Patented Oct. 4, 1853:

I claim, first, The combination of a rotating magazine, separate rotating charge receiver or conveyer, and gun barrel, for operation together, substantially as specified.

Second, Operating the rotating magazine and rotating charge receiver automatically by the action of the trigger guard, or its equivalent.

Third, The arrangement of the series of ball chamber, b b b, &c., and the series of powder chambers, a a a, &c., in concentric circles, and on the side of the gun barrel and out of the sight range, and so as not only to revolve and work against a common plate, E, affixed to the side of the gun, but to operate in conjunction with a rotary charge receiver, k, placed within the barrel, as specified, such arrangement of the magazine of chambers not only causing the powder of the charges to be kept in separate chambers, so as to lessen the danger of accident, but causing the magazine to be so arranged as to be out of range of the sight in taking aim.

Fourth, So to combine the percussion hammer or cock, rotary charge receiver and the rotary magazine with the trigger guard, that, by the movement of the said guard away from the stock, they may be simultaneously put in motion and the hammer brought up to full cock, as specified.

Notes & Queries

J. B. S., of N. Y.—You had better write to Guild, Garrison & Co., of Williamsburgh, N. Y., in reference to a small steam engine.

J. G., of Ala.—The fusible plug is an old invention. If ever patented, the term for which it was issued has long since expired.

H. G. L., of Conn.—The drops of water which you observed on cold stones and walls were condensed from the atmosphere, in the same way that water is condensed on the outside of a pitcher of ice water in warm weather.

D. M. C., of Ohio.—It seems to us that the proper mode of introducing your ideas to the public is to prepare a paper minutely describing your method of investigation and the results, and either send it to Silliman's *Journal* or read it before the American Association for the Advancement of Science.

F. C. L., of Ind.—The wheel which gave the largest results at the trial at the Philadelphia Waterworks was J. E. Stevenson's, illustrated on page 164 of our last volume. The useful effect of this wheel was .8777 of the total power of the water used, besides the friction of the machinery, which was estimated at 3 per cent, making the total yield .9077. These wheels are manufactured at the Novelty Works, in this city.

J. G., of Pa.—You will have perceived that Professor Silliman has answered Mr. Sprague. With his answer, the matter should rest.

A. H., of N. Y.—Cast and wrought iron are more brittle during severe frost than warm weather. Car axles and rails are stated to break more frequently in winter than summer; this is no doubt owing to frost rendering them brittle. We have never fully investigated the cause of this by experiment, although we are well aware of the fact.

St. Mary's, Ohio.—The best thing that you can do is to get up a wheel on the plan you propose, and test it practically. If you have occasion to address us again, see that you sign your letter, if you wish it answered.

B. B. H., of Mass.—To color the edge of your wooden shoe sole, first apply a very weak solution of copperas, and allow it to dry; then apply a very strong hot solution of logwood and sumac, which will color it a jet black.

R. W. E., of Miss.—You could not make a reliable and profitable working engine to be operated by the solar heat concentrated with "burning lens." The same project has been submitted to us several times, and in the "Romance of the Steam Engine," which we are now publishing, you will find it described as the invention of Solomon De Caus.

A. E. T., of Ohio.—A magnetic battery is not made with acids. As you want to remove iron and steel particles from gold, permanent magnets should be used for this purpose. Take a flat permanent magnet, and draw it through some gold dust containing steel filings, and they will be attracted to the surface of the magnet. They can then be brushed off, and thus separated from the gold.

E. W. D., of Conn.—You can tan muskrat skins by scraping the flesh side thoroughly, then steep them in cold solutions of sumac for about a week. You can color them dark brown with a liquor of fustic, Brazil wood and a little logwood. You should sew two skins with their flesh sides together, and plunge them in the coloring liquor.

G. A., of Ohio.—To make an emery belt, cover it first with a coat of glue, then dust on the emery thickly and allow it to dry; now give it another coat in the same manner, and allow it to dry, and your belt will be ready. You may also mix the emery with the glue, and lay the whole on at once with a brush; or, instead of glue, use copal varnish. The varnish is the best; and be sure to dry it in a room heated to about 212° Fah. It is best to put on the emery in several coats, allowing each to dry before the other is applied.

W. B. R., of Ky.—The electro-magnetic engine of Professor Page, for which Congress made a large appropriation several years ago, failed because it was far too expensive as a motive agent to compete with steam. It was, however, the best electro-magnetic engine we ever saw, and, for some situations, small engines constructed upon the same principles would be useful, and perhaps economical. Such engines could be used for working sewing machines and other light work in families. See the articles on electricity, now publishing in our columns, for further information on this subject.

D. McC., of Pa.—What we now want is some other person or persons who will try another set of experiments with steam working both at full stroke and expansively. The opinions which we entertain are similar to those in your letter, but we want facts; these, alone, will be satisfactory and conclusive.

H. W. B., of N. J.—Soft soaps are made with caustic potash, such as the ley of wood ashes; hard soaps are made with soda alkalies. Take two pounds of slacked lime and two pounds of salsoda; dissolve the latter in one gallon of hot water, mix them together, and allow the sediment to settle. Now take the clear liquor, and boil in it two pounds of tallow until it is completely dissolved: then take it out, cool in a pan, and you will have hard soap.

W. S., of Ill.—We cannot account for the explosion to which you refer in the chimney of a boiler, but by sudden ignition of an explosive gas in it. The volatile products of bituminous coal, when saturated with air, will explode like gunpowder when ignited. The explosions to which you refer will only occur when a new fire is put on, but if your furnace door were perforated with small holes, and the coals laid on at the edge of the furnace grate, no explosion would take place, as the gas would be burned in the fire as soon as it was liberated from the coals, instead of accumulating in the chimney.

C. C., of Pa.—Patents have been taken out in England for the manufacture of the tungstate of soda and the sulphate of ammonia, for preparing non-inflammable fabrics. Copies of these can be obtained by sending to London for them. But you can easily make the sulphate of ammonia with sulphuric acid and liquid ammonia. When combined, these two substances make the salt which you desire. They unite in definite proportions; therefore you will find no difficulty about the quantities of each to be used. The nitrate of lead is a good mordant for dyeing cotton with aniline, but the cotton should be first run through a weak starch liquor containing some soda ley.

J. W., of N. Y.—Gutta-percha shoe soles were not common in this city a few years since, but they are not now in use.

S. Y. D., of Maine.—You can apply any improvement you chose to a patented machine, and make as many repairs upon it as it requires. A patented machine sold by the patentee, with the unqualified right to use it, becomes the personal property of the purchaser, and he can do anything he pleases with it.

W. B., of Fla.—We believe that porpoise oil may be purified by simple churning in a wooden vessel for one hour; then allow it to settle, so as to permit the sediment to fall to the bottom. Rancid fish oil may be greatly improved by the cold process, by adding one ounce of dissolved pearl ash to every gallon, agitating it for a few hours, and then allowing it to settle. If you add two ounces of air-slacked lime to the one ounce of pearlash, and subject the oil to a simmering heat for two hours, the impurities will combine with the alkalies, and the oil will become a clear yellow color.

Money Received

At the Scientific American Office on account of Patent Office business, for the week ending Saturday, Jan. 12, 1861:—

H. R. D., of L. I., $100; H. S. W., of Mass., $25; A. & D., of N. H., $25; C. C., of Iowa, $30; A. S., of Ohio, $10; A. C. J., of Wis., $55; G. S. T., of Mich., $30; A. R., of Mich., $30; P. H., of Pa., $30; T. R. B., of R. I., $55; H. B., of Cal., $55; McN. K. Co., of N. Y., $250; J. R. A., of Ind., $30; B. Z., of N. Y., $20; A. G. T., of N. Y., $20; L. J. H., of N. Y., $20; F. C. S., of R. I., $30; L. & G., of Ill., $30; J. M. B., of N. J., $28; F. W. J., of N. Y., $25; J. A. P., of N. Y., $30; G. W. C., of Ga., $25; J. R. R., of Mass., $275; W. F. J., of Ohio, $30; H. P. G., of Pa, $15; H. N. W., of Conn., $25; D. K., of Pa., $30; R. C., of Texas, $75; H. H., of Pa., $30; R. McN., of N. Y., $40; J. W. N., of Pa., $25; J. D., of Iowa, $25; J. W. C., of Mich., $25; D. S., of Maine, $30; R. T., of Iowa, $25; I. M., of Ohio, $25; J. M., of Pa., $20.

Specifications, drawings and models belonging to parties with the following initials have been forwarded to the Patent Office during the week ending Jan. 12, 1861:—

A. & D., of N. H.; H. S. W., of Mass.; L. S. H., of N. Y.; R. McN., of N. Y.; H. H., of Pa.; H. P. S., of Pa.; J. R. A., of Ind.; M. R. W., of Ala.; H. N. W., of Conn.; J. M. B., of N. J; M. A. McL., of La.; G. W. C., of Ga.; A. L., of Ill.; F. W., of N. Y.; H. B., of Cal.; W. B. R., of La.; A. S. E., of Texas; A. & L., of Conn.

New Books and Periodicals Received.

Atlantic Monthly; Published by Ticknor & Fields, Boston.

The January number of the "Atlantic" has several interesting articles. The one on "Barbarism and Civilization" is crowded with facts; the account of Caspar Hauser is well written; and "Paul Revere's Ride," by Longfellow, is one of his best.

Blackwood's Magazine; republished by Leonard Scott & Co., No. 54 Gold-street, this city.

The last number of this venerable and able monthly contains a most interesting article on "Iron Clad Ships of War," and a thoroughly scientific article, by George Henry Lewis, on "Theories of Food," which criticises Liebig severely.

Important Hints to Our Readers.

Back Numbers and Volumes of the Scientific American.—Volumes I., II. and III. (bound or unbound) may be had at this office and from all periodical dealers. Price, bound, $1.50 per volume; by mail, $2—which includes postage. Price in sheets, $1. Every mechanic, inventor or artisan in the United States should have a complete set of this publication for reference. Subscribers should not fail to preserve their numbers for binding.

Patent Claims.—Persons desiring the claim of any invention which has been patented within thirty years, can obtain a copy by addressing a note to this office, stating the name of the patentee and date of patent, when known, and inclosing $1 as fee for copying. We can also furnish a sketch of any patented machine issued since 1853, to accompany the claim, on receipt of $2. Address MUNN & CO., Patent Solicitors, No. 37 Park Row, New York.

Binding.—We are prepared to bind volumes, in handsome covers, with illuminated sides, and to furnish covers for other binders. Price for binding, 50 cents. Price for covers, by mail, 50 cents by express or delivered at the office, 40 cents.

RATES OF ADVERTISING.

Thirty Cents per line for each and every insertion, payable in advance. To enable all to understand how to calculate the amount they must send when they wish advertisements published, we will explain that ten words average one line. Engravings will not be admitted into our advertising columns; and, as heretofore, the publishers reserve to themselves the right to reject any advertisement sent for publication.

Death of Dr. Hackley.

AT A MEETING OF THE SENIOR CLASS OF COLUMbia College on Thursday, Jan. 10, 1861, the following resolutions were adopted and ordered to be published:—

Whereas, We have been surprised and saddened by the intelligence of the death, this morning, of our venerated and beloved instructor, Rev. CHARLES W. HACKLEY, S. T. D., Professor of Astronomy in this institution; and

Whereas, In this afflictive dispensation of Divine Providence, a shadow of grief has fallen upon our whole College, and especially upon the Senior Class:

Therefore, We do unanimously *resolve* that, in the death of Dr. HACKLEY, who, for eighteen years, has been connected with this College, we have each suffered a personal bereavement, and our College a deep and mournful loss.

Resolved, That we hereby express our profound sorrow at the deprivation of the services of a most able and efficient instructor; the endearing association of a most urbane and dignified gentleman, and the example of a most amiable and consistent Christian.

Resolved, That we tender our most respectful and sincere sympathies and condolence to the afflicted family of the deceased, and join with them in the hope and prayer that they may be sustained in this mournful extremity by that Divine assistance and consolation which are never denied to those who submissively ask; and that the lesson of this occasion be improved to the personal warning and preparation of ourselves, each and all.

Resolved, That the Senior Class attend, as a body, the funeral of their beloved Professor, in their academical dress, and wear the usual badge of mourning for sixty days.

Resolved, That a copy of these resolutions be presented to the family of the deceased.

(Signed.) F. C. WHITEHOUSE, Chairman.
R. W. HOWES, Jr., Secretary.

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This report was in accordance with the awards at the Fair of the United States Agricultural Society; at the Fairs of the American Institute, New York; Mechanics' Association, Boston; Franklin Institute, Philadelphia; Metropolitan Mechanics' Institute, Washington; Mechanics' Institute, Baltimore; Mechanics' Association, Cincinnati; Kentucky Institute, Louisville; Mechanics' Association, St. Louis; Mechanics' Institute, San Francisco; at the State Fairs of Maine, Vermont, Connecticut, New York, New Jersey, Pennsylvania, Virginia, Mississippi, Missouri, Ohio, Indiana, Iowa, Tennessee, Illinois, Kentucky, Michigan, Wisconsin, California, and at hundreds of county fairs. 3 2*

THE GRAEFENBERG THEORY AND PRACTICE OF Medicine.—On the first day of May, 1860, the Graefenberg Company's Salesrooms, Consulting Offices and Medical Institute were removed from No. 34 Park-row to
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(first door from Broadway), in order to afford greater facilities and a more central location, demanded by the rapid increase of confidence in the Graefenberg Theory and Practice. The Graefenberg Theory and Practice, and the use of their medicines, together with complete symptoms of all diseases incident to this country and climate, the best method for their prevention and cure, will be found in the GRAEFENBERG MANUAL OF HEALTH.
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THOS. H. LANE, Agent.
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ANDREW CARNEGA, Supt. of Western Division.
Pittsburgh, Pa., Dec. 24, 1860. 4 4*

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Improvements in Marine Engines.

The arrangement of steam engines in boats and ships has furnished a full opportunity for the exertion of the very highest engineering ability that the world has ever known, and there is still room for the expenditure of an indefinite amount of ingenuity in this department. As Great Britain has the largest number of sea-going steamers of any nation, the largest amount of attention has been bestowed in that country upon all parts of their structure. The following description of an improvement patented in England by Mr. J. F. Spencer, which we find in the London *Engineer*, we regard of sufficient importance to justify its transference to our columns :—

In describing this invention, and the modes of carrying it into effect, the patentee illustrates its application to engines intended for driving the screw propeller, and he adopts for this purpose a type of engines which, he believes, particularly suited for commercial marine purposes.

In constructing direct-acting screw engines with inverted cylinders, he introduces under the cylinders and between their vertical centers a central case or hollow frame of a suitable form, and of sufficient size to receive the arrangement of horizontal tubes forming a surface condenser. In this condenser the tubes are placed horizontally or cut slightly inclined, and are in each case disposed across the line of the keel of the ship ; and the circulation of the condensing water is produced by mechanical means, and takes place within the thin metal tubes, whilst the steam to be condensed is brought in contact with the exterior surfaces. This central surface condenser forms the support to the cylinders on the inner sides, whilst the forward and aft portions of the cylinders are carried by columns or other framework secured to them, and also to the bedplate. The central surface condenser is supported upon, and secured to the bedplate by two chambered legs, one or both of which may be employed for, or used as a portion of, the condenser, the central body of which is raised sufficiently high above the level of the bedplate to allow the cranks to be drawn out or in endways. The side chests may be placed in such positions as may be found most convenient for giving motion to the slides, or for any other purpose. The air-pumps can be worked either by the main engine or by separate steam cylinders. By this arrangement of surface condensers, according to this invention, in inverted screw engines, ready access is secured to every part of the engine and condenser for the purposes of examination, cleaning, and repair, and more particularly it enables any of the condenser tubes to be removed and replaced without deranging any steam joint or connection in the engine, excepting only the water joints of the cover plate in the condenser case giving access to the ends of the condenser tubes.

In direct-acting engines for driving paddle-wheels, the patentee places the tubes in the direction of the line of the keel, and either horizontally or slightly inclined, and thus insures, as in the case of the application of the surface condensers to inverted screw engines, ready access to the tubes of the condensers, and the facility of removing them by withdrawing them from the case forming the central condenser, to which is connected each cylinder. It is intended, though not indispensable, that the condenser should form the support for the central bearing of the paddle shaft,

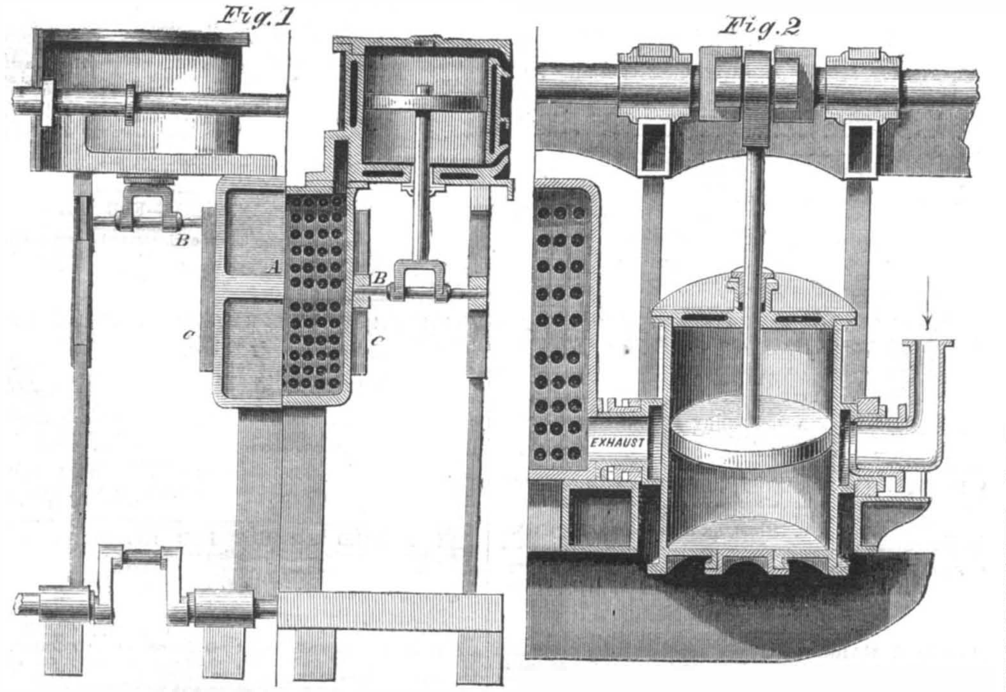
Mr. Spencer prefers to employ the following description of slide valve :—In ordinary marine engines, it is usual to relieve the main slide from the steam pressure by a faced ring at the back so fitted as to prevent the steam acting on a given surface of the back of the slide ; but when cut-off slides work on the back of the main slide, the arrangement ordinarily employed for relieving the pressure cannot be effectually carried out. But he is enabled to use one or more cut-off valves or slides, and at the same time to relieve the main slide from the steam pressure on its back ; and this is effected by causing the cut-off slide or slides to work in a chamber of a rectangular, or approximately rectangular, section formed at the back of the main slide. This chamber may either be a portion of the casting of the main slide, or a separate casting bolted on. It is formed by surrounding the back of the main slide with a supplementary back and side, the supplementary back being fitted with the faced ring before referred to, for relieving the back pressure, the supplementary sides and ends being perforated with apertures of any convenient size or form to admit the steam freely to the cut-off slides. By this arrangement the working of the cut-off slides does not interfere with the fitting of the faced ring ordinarily employed for the purpose of relieving the main or exhaust slide from the pressure of the steam, and forms a very useful adjunct to the marine engine.

In the engraving two descriptions of engines are shown, which will serve to illustrate the general features of this invention, and, for the purpose of avoiding complication, the figures are simplified materially.

Fig. 1 is a longitudinal elevational view, partly in section, of a pair of direct-acting cylinder screw engines having the surface condenser arranged according to this invention. The tubes in this case, it will be observed, are placed across the line of the keel of the vessel.

Fig. 2 is part of a transverse sectional elevation of a pair of direct-acting oscillating marine paddle-engines with surface condenser, &c., the tubes of the condenser in this case being placed in the direction of the line of the keel of the vessel, as shown, instead of athwartship, as in the direct acting marine screw engines described. In this view, as in the two preceding figures, A is the surface condenser. Any other letters of reference would be unnecessary, there being nothing novel in the form or arrangement of the engine.

In the inverted cylinder engines the cylinder is shown together with its top and bottoms covers, as hollow, for the purpose of surrounding the cylinders with steam of a suitably high temperature to prevent the undue condensation which would otherwise take place. In Fig. 2 is shown, for the sake of variation, the cylinder may be surrounded by a casing, and the bottom of each may likewise be hollow.



SPENCER'S IMPROVEMENTS IN MARINE ENGINES.

Curious Chemical Explosion.—On the 10th inst., an explosion of a remarkable character took place in Whitehouse & Co's. glass cutting and enameling establishment, situated in Nassau-street, Brooklyn. A still used for the generation of fluoric acid, which is much used to produce figures on glass by corrosion, exploded, and Mr. Whitehouse, the senior partner, received such injuries from it, as soon terminated his life. Fluoric acid is exceedingly dangerous ; its fumes are suffocating, and, in the liquid state, it burns flesh almost like fire. Mr. Whitehouse was highly respected by all who knew him, and he was an inventor and most skillful worker in ornamental glass.

Explosion of Teeth.—Explosions of boilers, cannon and carbines are not uncommon occurrences, but whoever heard of teeth exploding. Such phenomena, however, sometimes take place. A correspondent—W. H. Atkinson—of the *Dental Cosmos*, relates three cases of teeth exploding. He attributes these to the expansion of gases in the interior of the teeth, but how these gases were generated we are not informed.