SCIENTIFIC AMERICAN

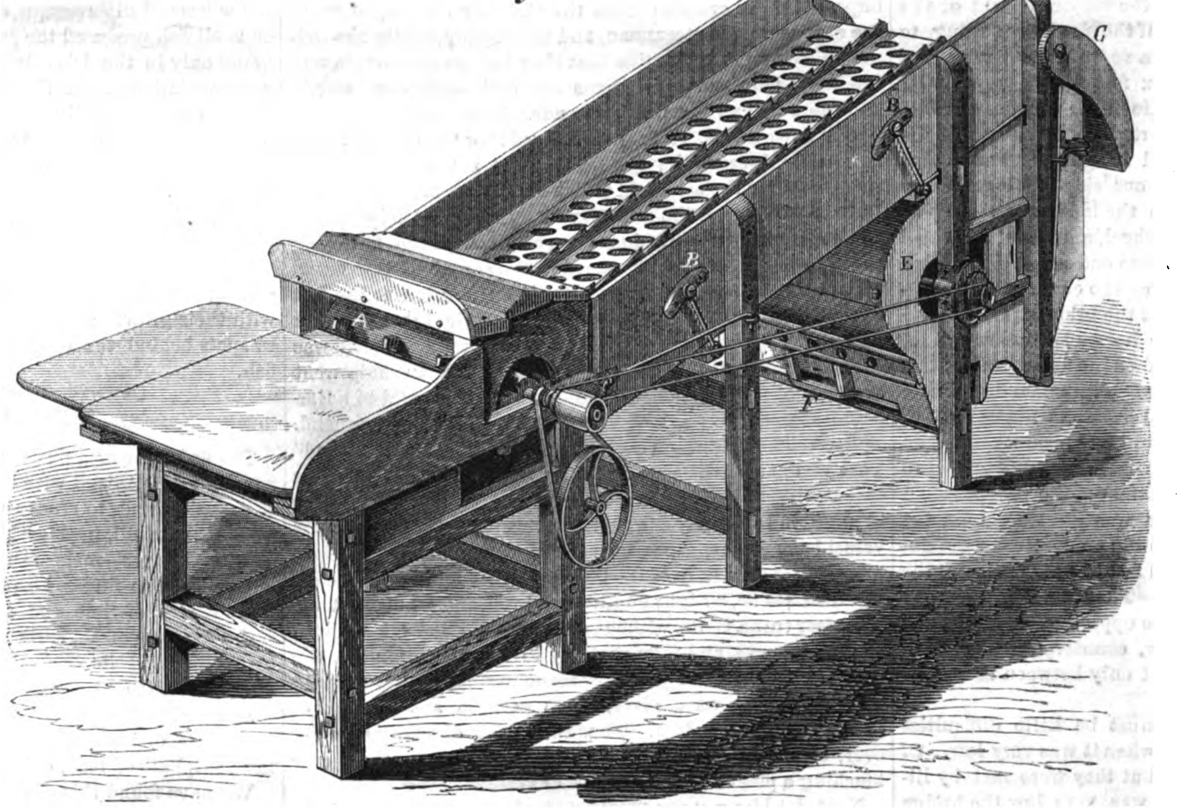
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XX.—No. 20. [NEW SERIES.] NEW YORK, MAY 15, 1869. $3 per Annum [IN ADVANCE.]

Improvement in Machine for Thrashing and Winnowing.

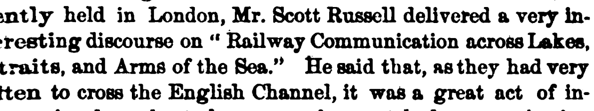
The combined machine herewith illustrated is intended for thrashing and winnowing wheat and other grains, and delivering the berries,or kernels,in a fit state for market,free from chaff, sand,and other impurities. It is driven by water, steam, horse, or other convenient power. The grain, as cut, is fed into the breaker or thrasher, A, as usual, the construction of this portion not being essentially different from that of ordinary thrashers. The straw and grain is then deposited, by the action of the rapidly-revolving thrasher-drum on the inclined perforated apron, which is double, as seen in the section, Fig. 2, and receives a rapid vibratory motion by the interposition of belts, the lower end being at the same time raised and lowered in consequence of the double apron being suspended from fixed points, B, on the sides of the machine. The serrated bars on the perforated incline receive the straw and by means of its rapid vibrating and lifting motion, the apron delivers the straw through the chute, C. The kernels and dust, with other impurities, not carried off with the straw, fall through the apertures in the upper floor of the incline on to the corrugated floor, D, Fig. 2, by which they are carried up and dropped from the upper end on to an incline, which carries them down to a series of vibrating sieves, the grain and debris being subjected to the action of a rapidly-revolving fan, E, that drives off the dust and light and imperfect kernels, the solid grains being discharged at F, ready for the market. A perforated slide, just over the delivery, F, may be used to regulate the supply of air to the fan to induce a stronger draft.

Fig. 1



SEIP & SCHMEYER'S COMBINED THRASHER AND FANNING MILL.

Fig. 2



A patent for these improvements is now pending through the Scientific American Patent Agency. Further information may be obtained by addressing Seip & Schmeyer, Macungie, Lehigh county, Pa.

HOW ENGINEERING DIFFICULTIES ARE OVERCOME.

At a meeting of the Institution of Naval Architects, recently held in London, Mr. Scott Russell delivered a very interesting discourse on "Railway Communication across Lakes, Straits, and Arms of the Sea." He said that, as they had very often to cross the English Channel, it was a great act of international cruelty to keep up such a wretched communication between Calais and Dover, as the great British nation and the great French nation now combined to keep up.

It was now more than three years since that eminent engineer, Mr. Fowler, became engineer to an association for putting a railway between Dover and Calais; and he (Mr. Scott Russell) was the naval architect for the steamships that were to make this communication. All the surveys had been made, all the plans had been prepared, and all the preliminary legal steps had been taken for bringing the scheme before the Houses of Parliament. But it was an unlucky period. Railway companies were quarreling with and ruining each other, and a scheme which merely interested the traveling public could not at that time command successful attention in the legislature or in the community. He might state that the plans had been fully matured. They had provided plans of the works by which railway trains would descend the pier at Dover, go into the vessel, cross over to Calais, and go from Calais right on to Paris, and *vice versa;* so that a passenger from London would, by a night train, take his seat or his bed in a railway carriage at London Bridge, and would open his eyes in the railway station at Paris, unconscious that he had crossed over the sea. That was a conclusion which he dared say people would gladly see realized; but he could not hold out any prospect of its being speedily realized, because we were such a patient people that it was likely for the next ten or twenty years we should be content to make passage as we had always done.

Curiously enough, about a year after this he was invited to look at the inland sea which separates Switzerland from Germany. What the Germans call the Bodensee, and what we call the Lake of Constance, was a great inland fresh-water sea, sixty or seventy miles long, and eight to twelve miles broad. The railways of Germany came close down to the German side of the lake, and the railways of Switzerland came down to the opposite side of the lake: and there the communication between the two countries was as completely interrupted as our communication with the Continent was blocked by the Straits of Dover. The reason why they did not carry the railway round the lake was obvious: the lake ran up into the precipitous Alps, and was continued over to the Italian side, so that no railway could find its way through. The Alps, with the Bodensee, formed an impassable barrier between Switzerland and Germany on one hand, and between Germany and the middle and south of France on the other. This was an enormous evil.

A large proportion of the supply of France with corn came last year from Hungary by railway and across the sea. Every sack of corn had to be unladen from the wagons, to be shipped, to be taken across, to be unshipped, to be reladen on the wagons. The cost of this transhipment, independent of the delay and blocking of the way, was greater than the carriage of the corn for the hundred miles by railway. It so happened that he had built the first fast vessel on that lake twenty years ago. It was a good, honest ship, and, as good, honest work always brought its own reward, he was called upon to solve the much more difficult problem of effecting communication between the railways on the two sides of the lake. The problem they set him was, "What we want is that you will make us the nearest thing you can to a railway, in order that we may let our trains, with their locomotive engines and everything, go across the lake as if it were a railway." Well, that was not difficult to do. The only difficulty was to do it well, cheaply, and in such a manner as to suit the peculiar circumstances of the case. The peculiar circumstances of the case were these: That at the entrance of the harbors the channels were shallow, not more than six feet deep. That was a difficulty. The next difficulty was that the harbors were so small that there was barely room for such a vessel as would carry a train to get into the harbor and turn round.

More than that, the entrances to the harbor were extremely narrow, so that in all these points, the case was a far more difficult one than the case between Dover and Calais. It might be said that he had not the great Atlantic waves to deal with. That was true; but there was something else—there was the terrific mountain hurricane, that came down so suddenly that it raised a nasty, short, sharp sea, and he need not tell them that a nasty, short, sharp sea, with a tremendous wind, was very often more troublesome to deal with, especially in shallow water, than a gentle swell would be. Another difficulty was a change of level of water, amounting to twelve feet from one extreme to the other. It was true this level did not change every day as at Dover, but it did change periodically, and therefore it was necessary to have a similar provision.

Having stated the peculiar circumstances of the case, he would shortly describe the manner in which those circumstances were met, and he would also state the results, because it would show that the difficulties between Dover and Calais could be met in a similar way. If he was asked the comparative difficulty of the two problems, he could not say that one problem was more difficult than the other. He had solved the Dover and Calais problem three years ago in plans, but he found that he had an enormous deal to learn and contrive before he could solve this particular problem in Switzerland. He proceeded to show how this problem was solved.

In the first place, he said to himself, "If they want me to continue the railway across the sea, I had better take a slice of the railway station, put a train and an engine into it, and send it over to the other side, and a train will then go on." He therefore took a section of a railway station 22 feet wide, and put upon that two lines of rail on one side and two lines of rail on the other side, leaving these two lines of rail to receive two railway trains. He had then to let in a locomotive engine, and so he had to make the roof of his railway station as high as a railway bridge, or a little higher than the top of the engine chimney.

The next thing was to float this bit of a railway station. Of course that was very easily done. He had only to put a construction below it in the nature of a ship, and, as there was only 6 feet of water, he had to take care that his vessel only drew 6 feet of water. The midships was 4 feet more out of the water when laden, so that below the railway platform there was a depth of 10 feet only. But this was not enough. Having got to propel the vessel, he had to place an engine room and boiler on each side, each 9 feet wide, making, with the 22 feet of railway, a total width of 40 feet. The boat had next to be fitted with paddles, which occupy a space of 10 feet on each side. So that, altogether, the structure was 60 feet beam. And when he stated that the harbors were from 80 feet to 100 feet wide at the entrance, and that he had to enter these harbors in hurricanes in shallow water, at a low velocity, with scarcely any steerage power, it would be seen that the task was not very easy.

Perhaps he ought to say a word about the engines. At the beginning there were a few particulars that bothered him. He wanted to get the paddle-shaft all through, but he could not. If he put it below it was too low; if he put it above it was too high; so he gave it up altogether, and simply put upon the shaft of each paddle wheel a couple of oscillating engines—one before the axle and one behind the axle. So he had a pair of engines to each wheel, perfectly independent of one another. A nautical friend would say to him, "You will get into precious difficulties with them." He knew he should. He knew very well that in a heavy wind, when one paddle wheel was deeper than the other, one engine would be flying away, and the other would be working very slowly. To counteract that he took a little indicator from the right engine room into the left engine room, and another indicator from the left engine room into the right engine room; and he made these indicators go round in the face of the engineer, so that he could not help looking at them when he was starting, or reversing, or moderating his engine. By this means engineer A was always looking at indicator B, and engineer B was always looking at indicator A; and in three days they had acquired such skill in handling the engines that engine A and engine B never advanced half a turn upon each other.

These were the difficulties he had on the cross section

There were also difficulties on the longitudinal section. On the line of rails he had to put his wagons, eight wagons on each line. German wagon were desperately long; but, having two lines of rails, he was enabled to carry nineteen wagons in all. The incovenience which he was obliged to submit to he had already mentioned, that arising from the shallowness of the water. He could not have deeper water than six feet, and he could not raise his vessel more than four feet above the water on account of the hight of the piers in the harbors. Therefore he was limited to ten feet deep. But he need not say that ten feet deep was much too shallow for a good strong vessel to stand this sort of work. Then came in the advantage of his railway station. What he did was to make the top of his railway station the top of an iron girder, and the sides of the railway station the sides of a ship; so that the ship, instead of being ten feet deep, was twenty-five feet deep from top to bottom, and the strength of the ship was at the top. This at once enabled him to get an enormously strong ship with a moderately light draft of water, and to have two decks, one above the other, the upper deck being the deck for strength, and also the most convenient deck for navigation, as well as the most preferable for passengers. There was also room for four first-class carriages outside this deck, two at each end. Here, then, was a solution of that difficulty.

The next difficulty was owing to the varying hight of the water and the varying immersions of the vessel according to its loading. He had to provide for a variation of twelve feet of water, six feet one way and six feet the other way. He managed it in this simple way: He made a railway bridge of steel 60 feet long, one end supported on the land and the other end was in the air. How did he get it into the air? Very easily. He merely put up on one side of this railway bridge a huge pillar of cast iron on the land. On the top of this pillar he put a great cast iron wheel, and round the wheel he put a chain cable. He attached one end of the chain cable to the bridge, and to the other end of the chain cable he attached a big weight half as heavy as the bridge. On the opposite side of the railway bridge he had another pillar, another wheel, another weight half as heavy as the bridge. Thus balanced, the railway bridge would remain in the air wherever you pleased to put it. But it was not content to stay there when the weight of the train was upon it; therefore it was necessary to keep it there by some other means, and so the chain was continued from the bottom of the weight round the wheel to a crane. When there was no weight on the bridge, if you gave a turn or two to the crane, the bridge got to the proper level; then they made fast to the crane, and the railway train went over the bridge. That was all; there was no merit in the contrivance. On the opposite shore there was another bridge hanging in the air, counterpoised by similar weights. The vessel oscillated only between those two points.

But it would be said that there must be little difficulties when the water was very high and when it was very low. Of course there were little difficulties, but they were met by little expedients. When the water was very low the bridge came a good deal over on the point of the boat and overlapped. There was a line of rail which ran down to each of the rails on the boat, and he need hardly tell a good engineer that as the boat "waggled" from one side to the other, he must make the bridge limp, so that it could "waggle" also, so that the train did not run off the rails. The bridge was made by a very good mechanical engineer, and for the life of him he could not get him to make any of his joints slack, so as to make the structure "wiggle-waggle." At last he did succeed in getting him to make the holes so big for the pins that the joints could "wiggle-waggle." This done, all difficulties disappeared.

A good locomotive engine-man could very easily drive his engine up an incline which was not more than four or five feet in a length of 60 feet or 70 feet. True it was a deep incline, but it was so short that there could not be many wagons at a time on it, so that, while one or two wagons were on the incline, the others would be on the level; thus any ordinary locomotive engine went up the incline without knowing it was on an incline. It might be said there would be a difficulty in coming down. There was a difficulty, and he expected the railway locomotive staff would have to undergo an education. He did not know any other way of making them undergo a thorough education than by letting them make some horrible blunder. He got the company to let him have a train of the oldest wagons they possessed. He told them secretly to make every preparation for taking the wagons out of harbor. He got the oldest locomotive engine they had, and he took care that the fireman and driver could swim. He found the brakesman could not swim, and on reflection he was glad of it, because they seemed dreadfully afraid of getting in, and the consequence was that not one of the brakesmen ever allowed a carriage to pass the chalk mark which he had drawn on the deck, because he could not swim.

Having made these arrangements, the practical result was, that by beginning gradually, and going on gradually, and giving the men a fortnight to learn, by making them put in trains and take out trains every day faster and faster, first with one carriage, then with two carriages, then with three, and ending with the locomotive engine, they at last acquired the power of doing all these things, which they thought at the beginning were impossibilities. These impossibilities were so accomplished that the term the people applied to the formidable enterprise, as they thought it, of putting a locomotive and train on board, *Kinderspiel*, which meant "child's play." There was no merit in all this, but there was one advantage, and that was simplicity. There was no machinery required, no fixed engines, no inclined planes, no moving machinery of any kind; there was simply a railway station, and all the appendages on both sides were nothing more than the common appendages of a railway station. Therefore he was proud of the word *Kinderspiel*.

These were all the land difficulties he had to overcome; there still remained water difficulties. The water difficulties were various. In the first place, how was he to navigate a ship which was 220 feet long out of and into a harbor which at no place was more than double that length, and where he had to wind in a circuitous route to quays where other vessels were being unloaded? It would be seen there was considerable difficulty in the navigation. The entrance to the harbors was in one case 100 feet wide, and in the other considerably under 100 feet. Of course in a dead calm, and with no speed on, the ship could get in and out. But when there was a hurricane blowing—for though this ship did not carry sail, yet with a long train, high out of the water, she would have some sideway on her with a strong wind—the task of getting into harbor was a difficult one. At the beginning it was thought this was an impossibility, and it was very near being an impossibility. When a big ship like that, drawing six feet of water, came into water six feet six inches deep, sailors said "she smelt the ground." In this case she so smelt the ground that she ceased to have any scent whatever for the the opinion of the steersman or the action of the rudder; and in shallow water such as that, the steering of a vessel 40 feet wide was impossible. In order to meet the difficulty he had to teach the engineers, the steersman, and the captain, totally new lessons. He ought to mention that they had no stem or stern to the boat; both ends were stems and both ends were sterns, and there was a rudder at both ends. There was a great difficulty down stairs. To say "Go ahead!" or "Go astern!" was impossible, because the engineers could not tell which end was meant for the stem and which for the stern.

At last he solved the difficulty by steering entirely by the two engines and abandoning the rudder, with the following code of rules: The captain stood in the center of the vessel with two tubes, one to the right engine, the other to the left engine. Out of these confined harbors they had to perform a very sharp circle to get out. But the plan they adopted was so successful that the first time they tried it the ship went right out of this complicated harbor, which was said to be impracticable with a rudder, and with a landsman in command. The command was given, "Right engine three turns!" That was part of the code that there should never be an order given without saying when the engine was to stop, "Right engine two turns, left engine three turns!" Accordingly the vessel began to describe a curve in order to get out of the harbor. If she did not describe the curve exactly, the next command would be, "Right engine two turns and a half, left engine four turns." So, without ever stopping, the ship went in the exact curve, and from that day to this, the moment the crew had learned this power of manœuvring, the vessel could be made to turn on a pivot, or to perform any number of curves without a rudder. Thus that great difficulty was got over, and the vessel now entered the harbor without ever touching a pier or touching another vessel.

Next, let him say one word as to the consequences of the construction of such a vessel. Trains coming from a great distance did not unload their goods, they went right across without delay, and the lake was now, for all practical purposes, a continuous railway. The time in putting a train on board was six minutes, the time in taking a train out was ten minutes, the time in going out of harbor was five minutes, the time in going into harbor was ten minutes, the time in crossing the sea was, the shortest, forty minutes, the longest, fifty-five minutes; so that in an hour and a quarter the whole operation was accomplished. Formerly the time occupied was two hours and a half. Need he say with regard to the heavy goods, such as machinery, engines, and boilers, that under the old system of craneage the labor of transporting them across the lake occupied several days?

He had now to say that, whereas everybody would talk of the impossibility of making a great floating railway across the Straits from Calais to Dover, there are also apparent impossibilities of every kind in the present instance, but only on half the scale. From Dover to Calais the distance was twenty miles; here it was ten miles. The ships proposed for Dover and Calais were 400 feet long; here they were 200 feet. The depth of water at Calais was difficult, but it might easily be made double the depth of the water in the Swiss harbors. With regard to the sea, where the waves were gentle swelling waves, they were of no consequence; it was only where the waves were short, sharp, striking waves, that they were of any consequence. He could assure them that if a vessel were made of the proper size, proportion, and shape, and of the right stability for these waves, there was scarcely a constitution so delicate that would not be able to cross from Dover to Calais without any sensation almost of having been on the top of the sea.

Capriciousness of the Colors of Fish.

A. C. Hamlin, in an article on "Salmon Fishing in Maine," contributed to *Lippincott's Magazine*, for May, says;

"The colors of fish are very capricious, and often depend upon local and adventitious influences. The coloring matter is not in the scales, but in the surface of the skin immediately beneath them, and is probably a secretion easily affected by the health of the fish, the quality of the water in which it lives, the light to which it is exposed, and the kind of food which it eats. In the dark waters which flow through boggy moors the tints of their finny inhabitants are deep: the light silver hues change to a golden yellow, and into the intermediate shades, even to a dark orange. But in the crystal waters of the purest stream, flowing over pebbly bottoms and white sands of decomposed quartz, the colors of the fish are very pure, and the luster is of such brilliancy as to give the appearance of transparency. We do not only observe this assimilation of color in fish to the places they frequent, but it is the same with the animals of the land. It is one of Nature's provisions, and is required for safety and concealment. Dr. Stark showed many years ago how suddenly the stickleback and other fish changed color when removed from dark pools and placed in white bowls. The change of hue took place with as much rapidity as though it were subject to the caprice of the fish, as is the case with the chameleon.

Food has a very decided influence, and, in connection with other circumstances, will produce a marked effect in the appearance of salmonidæ, even in the same lake. Thus in Lake Guarda, in Italy, we may observe one specimen with silver sides, blue back, and small black spots, and another of the same variety with yellow belly, red spots, and an olive-colored back. The like phenomena have been observed with trout of the same variety in the lakes of Germany and Ireland. Differences of food and habits, says Davy, may occasion, in a long course of ages, differences of shape and color which may be transmitted to offspring. Trout that frequent clear and cold waters, and feed much on larvæ and their cases, are not only red in flesh, but they become golden in hue, and the red spots increase and outnumber the black ones; but when feeding upon little fish they become more silvery in color and the black spots increase. We have some singular examples of the effects of difference of diet. The peculiarity of feeding on shell fish produced the gillaroo trout, a remarkable variety found only in the Irish lakes. The charr also is liable to great variations from the effects of its food, and its history has in consequence been much confused by the naturalists. We observe similar effects with the corregoni, or white fish; for instance, the powan of the Scottish and the pollan of the Irish lakes. Agassiz noticed that pet parrots, when fed upon certain fish of the Amazon, changed colors, and their green plumage became spotted with yellow.

Age also often causes a great difference in the appearance of fish, and the markings of the young change singularly with their growth; the Cornish sucker has two large ocellated spots behind the eye, which are not visible in the young fish.

WHAT IS A FLUX?

The definition of a flux is according to Morfit, "a substance usually saline, mixed with other bodies in order to promote their fusion, and to render them more soluble in water and acids." Mitchell, in his "Manual of Assaying," makes two classes of fluxes—metallic and non-metallic. Under the head of non-metallic fluxes, he places silica, lime, magnesia, alumina, silicates of lime and alumina, glass, borax, fluor-spar, carbonate of potash, carbonate of soda, niter, common salt, black flux and its equivalents, argol, salt of sorrel (binoxalate of potash), and soap.

In the class of metallic fluxes he places litharge, ceruse (carbonate of lead), glass of lead (silicate of lead), borate of lead, sulphate of lead, oxide of copper, and oxides of iron.

We have found this classification in no other work and we see no good basis for it. Oxides of metals are found in both classes, and many substances which might properly be considered as fluxes are not enumerated. Matthiessen in his definition of an alloy appears to us, to have given the entire philosophy of the action of fluxes. He defines an alloy as a "solidified solution of one metal in another." If this definition be accepted—and we see no reason for rejecting it—a metal which forms alloys with one of more difficult fusibility may be considered as a flux. A flux in this view is a solvent, which acts together with heat to reduce a solid to a liquid state.

The limits of this article will not admit of many illustrations of this definition of a flux, but one or two may be mentioned, premising that a flux most generally enters into chemical combination with the substance dissolved.

The use of borax in welding iron is one of the most common examples. The object to be attained in this case is the bringing of the surfaces of two pieces of iron so near together that cohesive attraction may unite them into one piece. This intimate approach can not be attained so long as the oxide which forms in the heating process remains upon the surfaces of the iron. The presence of borax prevents oxidation to a great extent by flowing over the surfaces; at the same time it liquefies whatever oxide is formed, so that the surfaces may be brought closely together and cohesion may take place. Sand is used in welding iron to iron for a similar purpose.

Mercury dissolves gold even at ordinary temperatures; the use of heat does not therefore alter the *rationale* of the action of fluxes, it only weakens the cohesive power of the substance to be fluxed so that the solvent action may readily take place. It therefore must be concluded that when a flux is used the melting of substances is not a process of simple fusion, but also one of solution.

Brickmaking in Scotland.

A writer in the *Scotsman*, on manufacturing in native clays, says: "The number of bricks made in Britain in the year 1802 was 714 millions; in 1840 it was 1,725 millions; and in 1850, the year in which the duty was abolished, it was 1,563½ millions. The number of bricks made in Scotland annually was 15½ millions in 1802, and 47¾ millions in 1840. If the great increase in railway and other works, the rapid enlargement of towns, and other recent causes leading to a more extensive use of bricks be considered, the number now made in Scotland cannot be less than 300 millions a year.

There are in Scotland 122 manufactories of bricks, tiles, and articles of a similar nature; and in connection with these from 4,000 to 5,000 persons are employed. The manufactories are widely scattered over the country, the farthest north being at Banff, and the farthest south at Dalbeattie; but the greater number are in Lanarkshire and Fifeshire, in which counties valuable beds of fire-clay exist. The most extensive manufactory is that of the Garnkirk Fire-clay Company, situated on the Caledonian Railway line, about six miles east from Glasgow. The company was originally formed to work coal, but, finding that extensive seams of fire-clay existed on their property, they took to manufacturing that material, which now almost exclusively engages their attention. The principal seam of clay is 7ft. in thickness, and lies at the average depth of twenty-eight fathoms. Its quality is considered equal to that of the best Stourbridge clay. The manufactory covers upwards of six acres of ground, and is surmounted by thirty tall brick chimneys, which give it an extraordinary appearance. Raw material is brought in, and finished goods are sent out, by branch railways, the traffic of which never ceases, from one week's end to another. Two hundred tuns of clay, and about an equal weight of coal, are used every day. Upwards of 300 men and boys are employed by the company, and these are aided by three steam engines with an aggregate of 150 horse-power. This is exclusive of the power employed to bring the clay and coal out of the pits. The clay is of a dark color, owing to the presence of a small proportion of bituminous matter; but when that is expelled by the action of fire, only silica and alumina remain, and it is the presence of these substances in certian proportions that decide the value of the clay. As it comes from the pits the clay is entirely devoid of cohesion or plasticity; and in order to bring it into working condition it has to be ground very fine, and then mixed with water. Several powerful mills are used for this purpose. They consist of great iron rollers, which travel round a circular trough, and pass over the clay. Several hundredweights of material are operated on at once, the time for which the grinding is continued depending on the quality of the articles to be produced.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. VI.

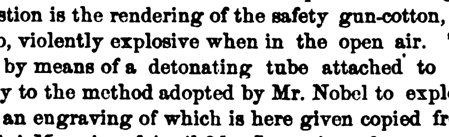
Concluded from page 274.

The second of the two principal opponents which gunpowder has to contend with is gun-cotton. This proposed substitute was discovered by Schonbein in 1846, since which time it has been greatly improved as far as regards manufacture, and attempts have been made in various countries to apply the material to purposes for which gunpowder hitherto had been alone used. In England, its manufacture on a large scale was commenced by Messrs. Hall, the gunpowder makers, at Faversham. An explosion, however, soon occurred at the works, killing a number of men, the cause being the spontaneous ignition of gun-cotton. This led to the abandonment of the manufacture on a large scale, and gun-cotton was apparently lost sight of until 1854, when Hadow published some results of his investigations into the nature of gun-cotton. In France, gun-cotton was made the subject of experiment as early as 1846, and its manufacture was carried on at the Government Powder Works at Bouchet, near Paris. Here, however, disastrous explosions also occurred—one in March, 1847, and two in 1848, several lives being lost. These disasters appear to have put an end until quite recently to experiments with guncotton in France. In Austria, where great attention has been paid to gun-cotton, Baron Von Lenk was commissioned to inquire into the merits of the material, and a manufactory of gun-cotton was established at the Castle of Hirtenburg, near Vienna. The material was applied for a while to cannon, but soon grew into disfavor, owing to its uncertainty of action. In 1862 an explosion occured in a magazine at Simmering, near Vienna, which caused the use of gun-cotton in artillery to be put a stop to; and in December, 1866, by order of the emperor, the use of gun-cotton by the Austrian artillery and crops of engineers was entirely prohibited.

Important progress has, however been made in the development and practical application of gun-cotton by Professor Abel and others, since its study was resumed in this country about six years ago.

Professor Abel has identified himself with the advancement of the gun-cotton question, and great credit is due to him for the light he has thrown upon that question by long and patient experimental research. Still greater credit is due to him for having discovered and perfected a method of treating gun-cotton whereby it is rendered non-explosive when burnt in the air, but in which the full energy is developed when fired in a close chamber. The method consists in reducing the gun-cotton fiber to a fine state of division or pulp, as in the process of paper making, and in converting this pulp into solid masses of any suitable form or density under a pressure of 18 tuns to the square inch.

The most recent feature in the development of the gun-cotton question is the rendering of the safety gun-cotton, just referred to, violently explosive when in the open air. This is effected by means of a detonating tube attached to a fuse, similarly to the method adopted by Mr. Nobel to explode dynamite, an engraving of which is here given copied from the *Mechanics' Magazine* of April 2d. It consists of a copper tube,



A, containing the fulminate. B is the ordinary mining fuse which is inserted in the tube. In firing the fuse is inserted in the tube, the opening, C, being nipped upon it with a pair of pliers. This tube is then inserted in the fuse-hole of the charge within about three-fourths of an inch of the charge and afterward fired. This safety gun-cotton, therefore, which will only burn in the open air if ignited by any ordinary means, will, it appears, develop all its deadly energy if fired under the same unconfined conditions, but with a special detonating fuse. In proof of this, some experiments were recently carried out at Stowmarket by Messrs. Prentice. The author appends a few particulars of these trials, which took place on January 22d. The first experiment consisted in placing a disk of gun-cotton, weighing about 1lb. 1oz., on the stump of a tree lately felled, and igniting it by an ordinary piece of miner's fuse. At the instant of ignition it was enveloped in flame, and moved about for the two or three seconds required for its combustion. About half the quantity was then placed on the same spot, and ignited by a small detonating fuse. A sharp, sudden report was heard, and the stump was found on inspection to be partly penetrated just where the charge had lain, while the twigs of the hedge close by suffered severely. The root of a large tree which lay on the ground was then attacked. A disk of gun-cotton, weighing about 1lb. 1oz., was placed in a hollow beneath it, a detonating fuse being inserted. The explosion shattered the old stump, and scattered its fragments in all directions. The next experiment was calculated to prove the question from a military point of view. A row of palisades, composed of trunks of trees, some 18in. in diameter, and all sunk 4ft. into the ground, was provided. A long tree trunk lay touching the foot of the palisade, and upon this 5lbs. of gun-cotton were laid. Wires communicating with a magnetic apparatus were affixed to a detonating tube, which was placed in contact with one of the disks of gun-cotton. Upon the explosion only one trunk was seen to fly away from the spot, and that proved to be the one upon which the charge had been placed; the palisades, although shaken, were comparatively unharmed. A charge of 15lbs. of gun-cotton was then placed against another part of the stockade, which was perfectly sound, and fired. The result was a general smash up, and a tumble over of all the trunks in numerous pieces; and so it ought to have been with such a charge as was employed.

If we compare the relative safety of dynamite and gun-cotton, there appears to be no difference between them. The only doubt upon Mr. Nursey's mind is whether, after long storage, any dangerous change may take place in either of the two substances. Mr. Nobel has endeavoured to answer this question with regard to dynamite, but the author thinks a year is scarcely sufficient time to determine this matter in such a comparatively recent discovery. So, too, with regard to the compressed gun-cotton. The author thinks a longer time must elapse before the new form of gun-cotton can be pronounced absolutely safe. The old gun-cotton was supposed to be safe in storage, but accidents at home and abroad have shown the contrary; and, however Professor Abel may now have eliminated the ellment of danger, as far as chemistry can, it is not for any one to say it is a reliable material until such time-tests have been applied as shall satisfy not only chemical science, but common sense. With regard to the question of relative powers of dynamite and gun-cotton, these appear also to be nearly evenly balanced; we may take it that for all practical purposes they are so. It would appear, however, to the author that dynamite was actually the stronger of the two, for, from his experience of that substance, he thinks that much less than 5lbs. of dynamite would have effected what 5lb. of gun-cotton failed to do at the palisade experiments—viz., to demolish it.

The most deadly explosives are at hand ready for work, but as harmless for mischief as so much sawdust or paper. They may be transported with safety, and played with by a child when unconfined; but when imprisoned they will tear down the hardest rock in liberating their gases. These are some of the marvels of the age in which we live, but which some new scientific discovery may eclipse before many years pass over.

The Senate Committee on Pacific Railroads.

"The report of the Senate Committee on Pacific Railroads favors two additional trunk railroads to the Pacific—one from Lake Superior to Puget's Sound; the other from Little Rock, in Arkansas, and from the terminus of the Kansas Pacific railway in Kansas, by the route of the thirty-fifth parallel, to San Diego and San Francisco. The report declares that the bill reported by the majority of the committee was intended to be the finality of legislation in aid of Pacific railways; that after having provided substantially two additional trunk outlets—one for the Northern States and one for the Southern States—at suitable initial points, it was intended to stop there all Congressional aid, and leave to private enterprise and State endowment the future construction of branches. The report shows at length, and with a large array of statistics, derived from the experience of the influence of railways in England, France, Belgium, Holland, and the United States, that they are the greatest of all modern agencies for the production of wealth and the development of trade and commerce. It demonstrates that the import and export trade of the principal countries in Europe are in precise proportion to the development of their railway systems, respectively; that the experience of Belgium, France, Austria, Spain, and Italy, shows that a tax on railway receipts is the best sinking fund thus far devised for the speedy payment of national debts. It also shows that two additional trunk railways to the Pacific are commercially necessary, demonstrating that a single line cannot do the work that will be thrown upon it; that additional lines, free from obstruction by snow, are needed to maintain uninterrupted intercourse; to prevent the evils of a monopoly; to avoid political discontent in the Northern and Southern sections of the Union; to bring the public domain into market; to increase immigration from Europe; to quadruple our yield of gold and silver; to save two-thirds of the cost of wagoning supplies to the 109 military posts in the Indian country, which now amounts to about seventeen millions a year; to reduce by one-half the number of troops maintained in the Territories by the greater mobility the roads will give the remainder, and to practically end Indian wars, which the report shows cost the country during the last campaign about one million dollars a week. The majority of the committee urgently recommend aid to the roads as a measure of immediate and lasting economy to the Government. The report proves that it is safe for the Government to aid them, without reference to the incidental advantages of doing so, by showing from the accounts of the Quartermaster's Department with the Kansas Pacific Railroad that upon an average use of 220 miles of the road its earning for work done for the Govrenment not only paid the interest on the bonds advanced to the road and provided the sinking fund to redeem them, but brought the Government in debt to the road. The report opposes grants hereafter of Government aid like that given to the Union Pacific and Central Pacific, in bonds directly issued, but advocates a guarantee of the interest of the mortgage bonds of the two additional trunk Pacific roads, to be issued to a defined and limited extent. It declares that they are military, commercial, and political necessities, and concludes with the averment that the people demand their construction, and do not, as has been alleged, participate in, or sympathize with, the recently raised outcry against Pacific Railway aid."

This is all very well. We are in favor of railways and other internal improvements, but it has become a very serious question and it is one in which "the plain people" are interested—namely, can these railroads be built, or can any public enterprise be carried on now without swindling? A few years ago we could answer this inquiry in the affirmative, but in these latter days there seems to be a job in every work of a public character. It is also charged that Members of Congress are in these things. Is it not, therefore, about time for us as a people to stop just long enough to find out whether we are not rushing on a little too fast? We fear that the country cannot much longer sustain such manifest disregard of honesty in public affairs.

Lumber of the Upper Mississippi.

The lumber product of the Upper Mississippi and its tributaries was very large last year, and it is estimated that the supply for 1869 will amount to six hundred and twenty million feet. Less than half this amount was cut in 1857, and yet the lumbermen of this region suffered heavy losses from the slight demand. Now, however, it is asserted, that the business is sure and very remunerative. The extension of the railroads in the adjacent States, and the construction of the Union Pacific, are assigned as the causes of this usual prosperity. A single lumbering firm in Minnesota is reported as owning over 100,000 acres of selected pine land. It is feared that the trees of this region will all be cut down, and that the land will remain desolate.

Amateur and Scientific Farming.

Mr. J. H. Hall, a member of the Farmers' Club and New York State Poultry Society, has purchased a farm on Long Island for the purpose of testing general questions of interest in agriculture. One of these is the value of artificial manures, the profitable growing of imported seeds from Washington, and the feasibility of raising poultry on a large scale, Dr. Pratterre, of the Eccelabeon celebrity, has kindly consented to aid him in the hatching of eggs by the hundred with his imported and improved machine.

The eleventh exhibition of American manufactures, machinery, new inventions and works of art, under the direction of the Massachusetts Charitable Mechanics' Association, will open in Boston on Wednesday, September 15th. Faneuil Hall and Quincy Hall will be used as heretofore, and it is in contemplation to erect in South Market street a building several hundred feet in length to afford accommodation for the proper display of articles which have heretofore lacked proper space for an appropriate display. This building will be erected on iron pillars, and will not interfere with the trade or travel of the thoroughfare.

Applicants for Patents want their claims examined more promptly. The Patent Office has got into a very lazy condition, and needs to be stirred up. Commissioner Fisher cannot do a better service at the outset than to devise measures to clean the docket of pending cases. Upon investigating the condition of the Patent Office in this respect he will find it very unsatisfactory. Examiners might, if they would, per form a little extra labor to bring up the back work of the Office.

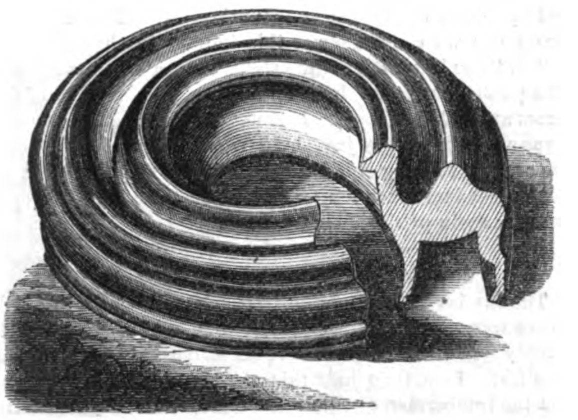
Lighting up the Stomach.—We find the following curious statement in a Canadian paper: "M. Milliat, in France, introduces into the stomach, glass tubes of small caliber, connected with a strong battery, and containing the electrodes necessary for producing a brilliant galvanic light. Tumors or ulcers in the abdomen can thus be observed through the skin, and the interior lit up as when the feeble light of a candle renders the finger translucent.

Sunflower Seed Tea—A Remedy for Summer Complaint.—A correspondent writes us that a tea made of the seeds of the sunflower, roasted like coffee berries, are an admirable remedy for all species of summer complaint. A half pint of the seed is sufficient. It should be remembered, however, that serious results often follow the too sudden stoppage of diarrhœa by astringents, and with this, as all remedies of a similar nature, caution should be used.

A Texas gentleman has received a quantity of silkworm eggs from France through the post. Some of the eggs hatched on the way, and the worms were living on their arrival.

Timber Beasts.

Mr. John R. Jackson, Kew, contributes the following curious article to *The Gardener's Chronicle*: That economic botany has a wide range of application the varied contents of the museum at Kew clearly illustrates. One of the most peculiar, and at the same time amusing of recent additions to that collection, is a series showing the mode of manufacture of children's toys as carried on in Saxony, and presented by Dr. Reichenbach. Everyone knows what a child's Noah's Ark is, and everyone is more or less acquainted with the orthodox forms of the representations of the beasts which it contains; and further than this we believe most of us have at some time asked ourselves the question, "How is it possible for these toys to be made, brought into this country, and sold at so low a price as they usually are?" But this question is partly solved by a glance at the collection at Kew. The wood used is the common white deal of carpenters, and the mode of manufacture is so ingenious that a description of it cannot fail to be of interest. The wood is first turned in a lathe in circular pieces, which look when entire very like circular picture frames. Cross sections of the proper width required are then cut out of these "frames" in the direction of the grain of the wood where a horse, a cow, a lamb, or a dog, or whatever animal has been designed in the lathe, presents itself. This will be more clearly understood from the accompanying figures. The section now has to be finished by hand; all it



requires, however, is to have the angles rounded and smoothed, and the tail, horns, etc., which are turned in separate pieces, attached; after which the whole is painted, and the animal is complete. In the case of an elephant, the ears, tusks, and trunk are all turned in distinct circular pieces, and sections are cut out in a similar manner to those intended for the body. This mode of manufacture is very ingenious, and in some degree explains the possibility of the production and importation of such large quantities of these toys for sale at such cheap rates. Since these specimens have been exhibited at Kew, they have attracted a large share of the attention of the numerous visitors who flock there.

The Golden House of Nero.

On that part of the ruins of Imperial Rome lying between the Palatine and the Esquiline Hills—a space which was more than a mile in breadth—Nero erected his "Golden House," as he called the new palace in which he fixed his abode. The vastness of extent and the varied magnificence of this imperial residence and its ornamental grounds almost surpass belief; and if the details that have come down to us respecting it were not too well authenticated to admit of doubt, they might be regarded as fabulous. Within its inclosure were comprised spacious fields, groves, orchards, and vineyards; artificial lakes, hills, and dense woods, after the manner of a solitude or wilderness. The palace itself consisted of magnificent buildings raised on the shores of the lake. The various wings were united by galleries each a mile in length. The house or immediate dwelling of the emperor was decorated in a style of excessive gorgeousness. It was roofed entirely with golden tiles, and with the same precious metal the marble sheathing of the walls was also profusely decked, being at the same time embellished with ornaments of mother-o'-pearl—in those times valued more highly than gold—and with a profusion of precious stones. The ceilings and woodwork were inlaid with ivory and gold, and the roof of the grand banqueting-hall was constructed to resemble the firmament. It was contrived to have a rotatory motion, so as to imitate the motion of the heavenly bodies. The vaulted ceiling of ivory opened and let in on the guests a profusion of flowers, and golden pipes sprayed over them the most delicate perfumes.

Stewart's New Model Dwelling.

We have already noticed the grand project of Mr. A. T. Stewart, of this city, to construct a model dwelling, designed as a home for worthy working women. The *Evening Post* gives additional particulars concerning the structure, which are worthy of attention. Mr. Stewart's purpose is to erect a magnificent palace of iron, somewhat resembling his store on the corner of Broadway and Tenth street, which will have stores on its ground floor, and sleeping and eating accommodations for fifteen hundred persons in the remaining stories of the building. The extent of the new structure will be 197½ feet on Fourth avenue, and 205 feet on both Thirty-second and Thirty-third streets. It will surround a court 100 feet square, and, consequently, every apartment will possess windows upon the open air, and ample consequent ventilation. The hight will be seven stories upon the Fourth avenue, in addition to the basement, and eight stories upon the side streets. The whole building will be painted white, externally and internally, and crowned with a Mansard roof of slate. It will be bricked behind the iron walls, and be thoroughly fireproof. The staircases will be of iron, and an elevator will be attached, which will transport luggage and residents to the various stories. A water tank will exist on the top of the house, and water will be in abundance upon every floor. The rooms will each be heated by a coil of pipes, affording means of regulating the temperature. Those for sleeping purposes will either be small, for single inmates, or eight feet by eighteen, for two persons. Others will be sixteen feet by eighteen, for four persons. All will be well furnished, and contain every essential convenience. The partitions will be of iron and brick. As little wood will be employed in the building as practicable. Bedsteads and tables will be of iron. The basement will contain the engine and heating apparatus, bathrooms, and storerooms of different kinds. In the back part of the ground floor, which will have no face on the street, and cannot be used for stores, the kitchen and laundry will be located. Above these will be the restaurant or dining room, and a large parlor for social purposes, elegantly furnished. To this a library and reading room will be added. The cost of the whole may exceed $3,000,000. A handsome interest upon this will be met, to a large degree, by the lease of the numerous stores below, leaving a very small sum to be paid for each of the rooms. The food furnished in the restaurant will be at cost, in addition to the expense of cooking, serving, etc., and it is calculated that an inmate will be able to live abundantly well, washing, rent, and food included, for little more than $2 a week. The more numerous the household, the less the expense to each.

Hartford Steam Boiler Inspection and Insurance Company.

The following report of this Company's inspections during the month of March is made to its directors:

During the month 327 visits of inspection were made and 628 boilers examined—548 externally and 181 internally—while 47 were tested by hydraulic pressure. The number of defects in all discovered, 404. Number of dangerous defects, 63. These defects were as follows: Furnaces out of shape, 7; fractures, 116—34 dangerous; burned plates, 39—6 dangerous; blistered plates 57—5 dangerous; cases of incrustation and scale, 70—5 dangerous; cases of external corrosion, 36—1 dangerous; water gages out of order, 20; blow-out apparatus out of order, 11—1 dangerous; safety valves overloaded, 20—4 dangerous; pressure gages out of order, 38—5 dangerous; boilers without gages, 9; cases of deficiency of water, 7—4 dangerous; cases of internal grooving, 3.

The unusually large number of defects reported may be accounted for by the fact that considerable work for the month was done in mining and iron-working districts. The boilers of mines and iron works are usually urged to their full capacity and almost constantly, hence the opportunities for frequent examinations are less than in many and most other establishments. By dangerous defects we mean those that are liable to result in rupture or explosion at any time. Fractures are very common, and, as will be noticed, outnumber other defects. These occur from various causes—overpressure, burned plates, cold water on hot plates, and faulty construction.

The tendency of manufacturers to continue in use boilers of too limited capacity for their wants is the direct cause of many disasters. There is no valid excuse for this, for while the increasing business of a manufacturer demands additional machinery, he should remember that the boiler power adapted to his early beginning is ill adapted to present wants. This is, however, frequently overlooked, and a forty-horse power boiler is made to do the work of a sixty, or even more. This goes on until continual repairing becomes a nuisance or the boiler actually explodes.

Sufficient attention is not given to the feed water in rural districts. In many instances the water is gathered in ponds and contains much vegetable matter. This makes a deposit of greater or less thickness, which should be frequently removed if the manufacturer has not the means of filtering the water thoroughly before it is pumped into the boiler. Incrustation, deposit, and scale seriously interfere with the rapid generation of steam; hence, motives of economy should lead steam users to frequently clean their boilers.

In one instance, where insurance was desired, the engineer was requested to "blow out" the boiler, when he replied: "It must be pumped out for we have no place to 'blow it off.'" On examination it was found that the boiler had neither blow-out pipes nor hand holes. It had not been opened for more than two years. Is it a wonder that boilers explode?

The explosions during the month have been numerous and disastrous. Yet, while many of the boilers under the care of this company have been found in dangerous conditions, none have exploded. It may be well to add that on inspection all boilers found to be in an unsafe condition are regarded as uninsurable until thoroughly repaired.

A New Copying Ink.

A black copying ink, which flows easily from the pen, and will enable any one to obtain very sharp copies without the aid of a press, can be prepared in the following manner: One ounce of coarsely broken extract of logwood and two drachms of crystallized carbonate of soda are placed in a porcelain capsule with eight ounces of distilled water, and heated until the solution is of a deep red color, and all the extract is dissolved. The capsule is then taken from the fire. Stir well into the mixture one ounce of glycerin of a specific gravity of 1·25, fifteen grains of neutral chromate of potash, dissolved in a little water, and two drachms of finely pulverized gum arabic, which may be previously dissolved in a little hot water so as to produce a mucilaginous solution. The ink is now complete and ready for use.

In well-closed bottles it may be kept for a long time without getting moldy, and, however old it may be, will allow copies of writing to be taken without the aid of a press. It does not attack steel pens. This ink cannot be used with a copying press. Its impression is taken on thin moistened copying paper, at the back of which is placed a sheet of writing paper.

BEET ROOT SUGAR.

No. VIII.

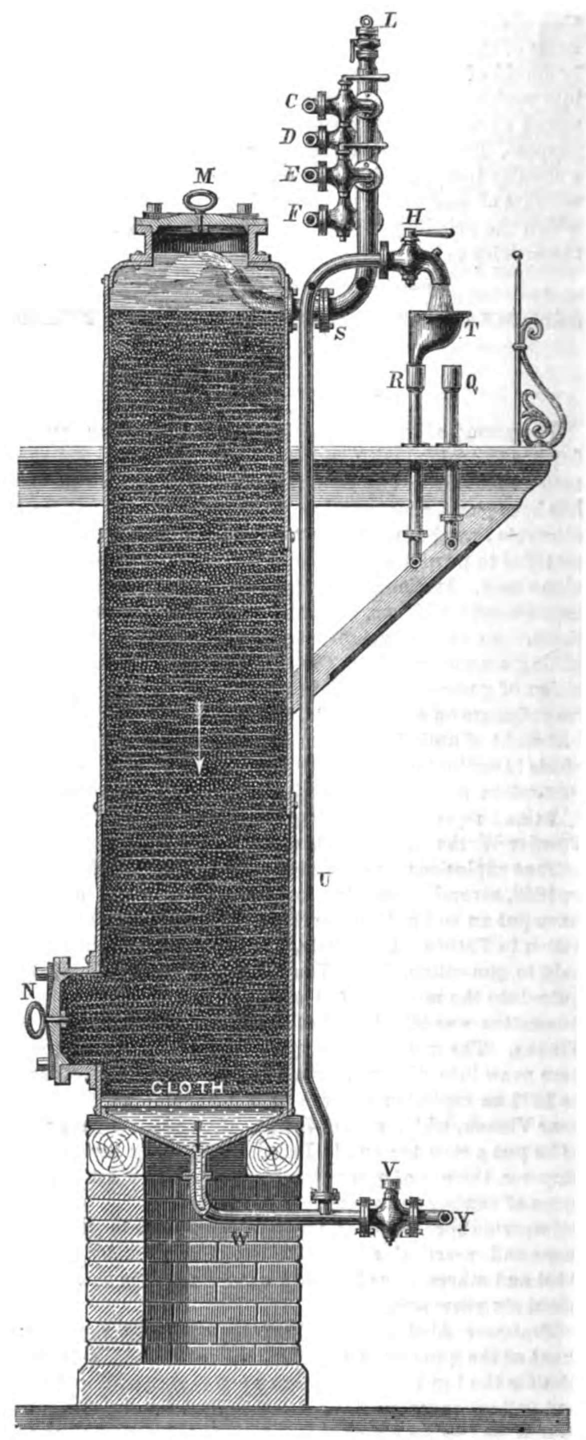
Technology.—Part V.

FILTRATION AND CONCENTRATION OF THE JUICE.

After leaving the carbonatation pans, the beet root juice, retaining still a certain proportion of both organic and inorganic impurities, is run into a tank or reservoir, from which it is conveyed into large filters, filled with granulated bone-black. These filters are upright cylindrical vessels, made of boiler plate, generally from 12 to 15 feet high, with an internal diameter of from 39 to 40 inches.

Several filters are always placed in a row, in close proximity to one another, forming what is called a filter "battery."

The following figure is a section through one of the filters in



such a battery. M is a cover, fitting very tightly on the top, through which the bone black is introduced. N is a man-hole for drawing out the spent bone black, and also for admitting a sieve, covered by a cloth spread carefully over it, which is introduced into the bottom of the filter before the bone black is admitted. S is a wide pipe for the introduction of steam, pure water, beet root juice, and sirups into the filter; this is effected by means of the pipes, F E, D C, which are in connection with S, through which the passage of either of these fluids is regulated at will by means of special cocks.

In order to preclude the possibility of mistakes being made by the workmen in the handling of these cocks, the pipes are superposed in the order of the density of the substances which are to be run through them, thus the steam pipe, F, is the lowest, next comes the clear water pipe, E, next that for the carbonatated juice, D, and uppermost of all, the pipe for conveying sirups, C.

The steam pipe, F, is connected with the other three by means of a smaller pipe, in order to permit of their being occasionally cleaned by blowing steam through them.

The reservoir for carbonatated juice is placed above the top of the filters; the higher the better, as it increases the hydraulic pressure, and forces the juice through the bone black with greater energy.

The pipe, S, is also fitted with a small connecting pipe, L, through which the air escapes from the filter as it is gradually filling with liquid. The juice, after having traversed from top to bottom the whole body of bone black in the filter, is not allowed to run out at the bottom through the pipes W Y; the cock, V, being kept closed so as to force it to ascend through the upright pipe, U, from whence it is allowed to flow out through the open cock, H.

This arrangement prevents a filter from ever running dry, as it will necessarily always remain full of juice to the level of H.

The juice is received in a movable funnel, T, which fits on the upright pipes, R and Q. If juice is being run through the filter, the funnel is placed on R, and is thus conveyed either directly to a tank, to a *monte-jus*, or to the evaporating pans, according to the disposition of the works. If sirup is being passed through the filter, the funnel is placed on Q and run to the concentrating pans, either directly or through a special *monte-jus*.

When not in use, the top orifices of the pipes, R and Q, must always be carefully closed by metallic plugs. The accidental introduction of foreign substances into these pipes would cause very considerable trouble, loss of time, and expense.

As in some cases it is necessary to filter the same solution twice over, a communication is often established between contiguous filters by means of a special system of pipes and cocks.

In our figure, V is used for running water into the pipe Y, which carries it off as waste, or which conveys it to the bone black department, where it is used in the process of "fermentation," which we shall describe in due time.

Filtration of the whole of the products undergoing the processes of manufacture takes place normally twice before crystallized sugar is produced from it. The first filtration is that of the carbonated juice; the second is this juice, after it has been subjected to evaporation, until it has reached the consistence of a thin "sirup." The working of the filters in a battery being simultaneous for both juice and sirup, and to a certain extent combined, the same filters being first used for sirups, and subsequently for juice, we shall reserve our account of the *modus operandi* of filtration in general until we shall treat of the purification of sirups.

After leaving the filters, the clear juice is conveyed to the evaporating pans, where it is reduced to a certain degree of consistency, "sirup," after which it has to be filtered a second time, as we have already said.

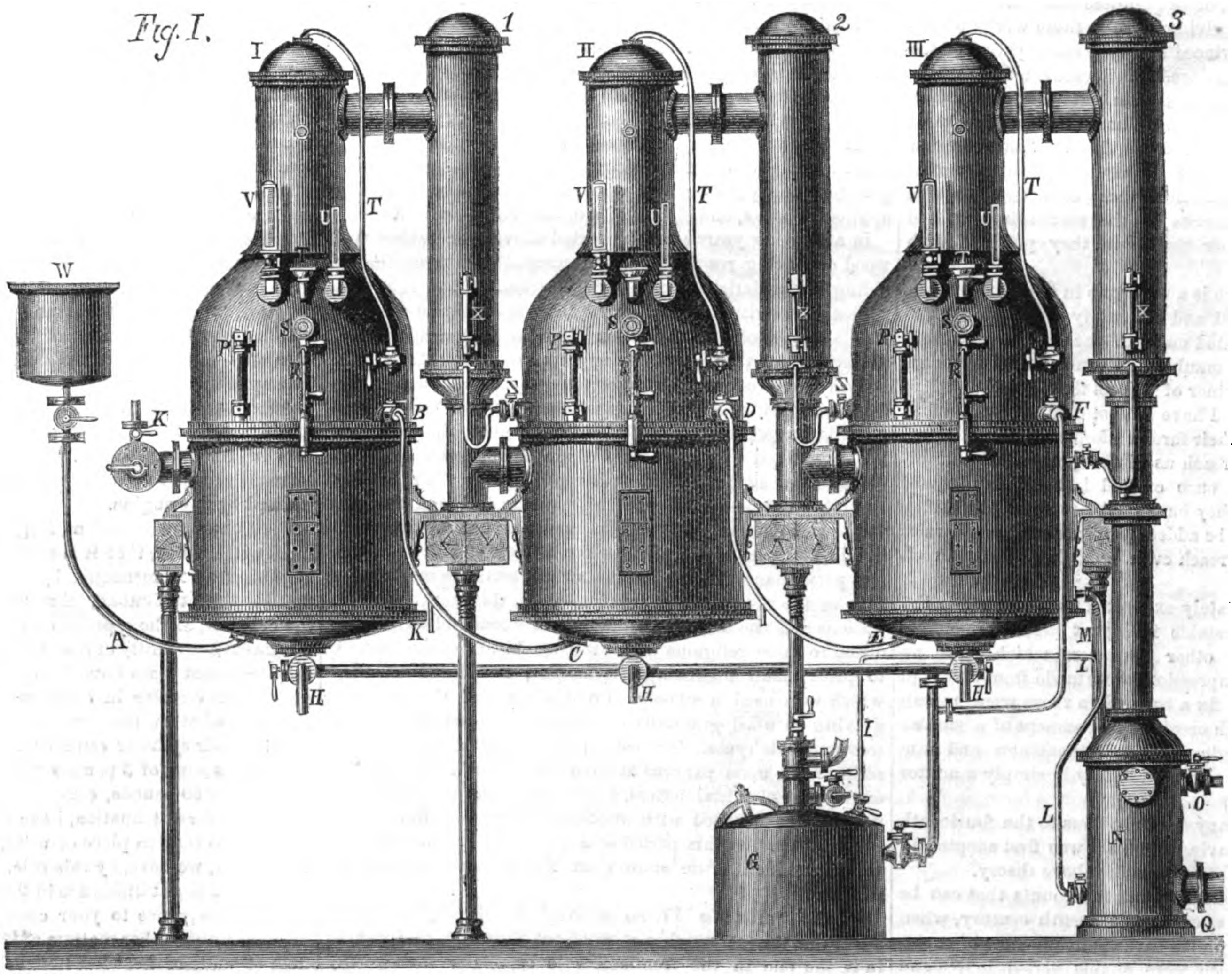
Evaporating pans in the olden times, were simple contrivances, and consisted in open boilers, either heated by the direct action of fire or by steam passing through double bottoms, or coil pipes. Some small sugar factories still use this latter system, which is wasteful in fuel and makes sugar of a more inferior quality than is done by the more perfect appliances of our day, known as the "triple effect vacuum pans."

It would be tedious and unprofitable for us to sketch the history of the gradual progress in the perfection of vacuum pans, from the primitive Rillieux "double effect pan" to the more perfect "triple effects" now in use. We shall consequently limit ourselves here to the description of one of the best known, "Robert's pan," which, if well understood, will permit the reader to readily comprehend the working of all others, no matter what modifications or improvements they may present. Let us add, in this respect, that the original Robert vacuum pan is hardly to be found in any manufactory unless it has been more or less altered in some details of its construction. Before explaining the use and advantages of the vacuum pan, we give a description of its various parts, which will facilitate our task.

Fig. 1 is a side view of the whole apparatus. The three pans, or bodies, are marked I, II, III, the three intermediate vapor columns are numbered 1, 2, 3. A is the pipe which carries the juice into the first body. B C is a pipe which carries the juice from the first body to the second, and G F, another which conveys it from the second to the third body, from whence the pipe, F, takes it to the *monte-jus*, G. H is a pipe through which the pans can be entirely emptied. I is a pipe communicating a vacuum from the condenser to the *monte-jus*. K is a pipe and valve for introducing the steam for heating into the first body. K' is a pipe for running off condensed water. L M is a pipe for conveying spent steam and condensed water to the condenser, N. O is the injection pipe of the condenser. Q is the outlet for the hot water of condensation. P is a glass indicator for the hight of the juice in the pan. R is the apparatus for sampling, in order to learn the density of the juice. S represents the glass bull's-eye for observing the progress of ebullition. T is a small funnel for the introduction of melted fat to arrest too violent ebullition. T' is the small cock for admission of air. U is a thermometer indicating the temperature of the boiling juice. V is a special barometer for low pressures for determining the degree of vacuum. X is an indicator for the water accidentally collected in the columns. Z is the pipe for running out the liquid which has found its way into the column.

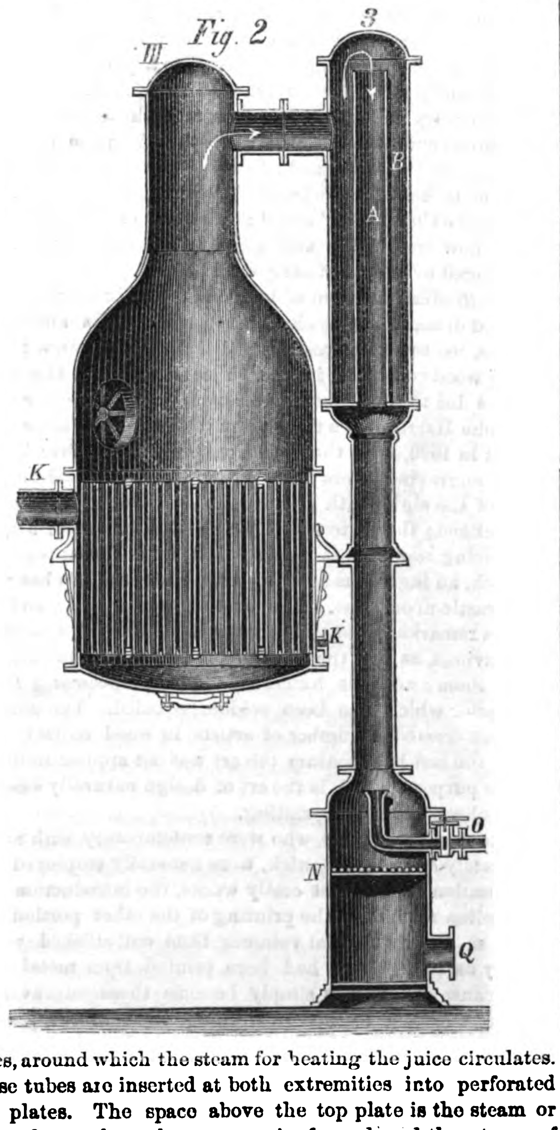
A man-hole is constructed in each body, but not figured in our cut, as it is placed at the back of the pan, as here exhibited.

Fig. 2 shows a section through the last body of the above apparatus, so as to give a view of the internal arrangement of a vacuum pan.



ROBERT'S TRIPLE-EFFECT VACUUM PAN.

The lower portion of the body, III, shows the disposition of the



tubes, around which the steam for heating the juice circulates. These tubes are inserted at both extremities into perforated end plates. The space above the top plate is the steam or vapor chest, where the vacuum is formed, and the steam of the boiling juice collects before being carried off. N is the condenser; O its injection pipe; M the exit pipe for heated condensation water, which is drawn off by an air pump; A is an upright pipe surrounded by an empty space, B, in which accidental water and liquid collects.

In our next article we shall furnish a concise exposition of the theory and practice of the working of the triple-effect vacuum pan.

The Spring Freshets.

It is said that the spring floods of 1869 have been unusually destructive. On the Connecticut river, the height of the water has only been exceeded four times in the last seventy years. In Hartford, the water on April 23d, at noon, was 26 feet 8 inches above the low water mark. In 1854, the gage marked 30 feet. In Canada, the ice began to move out of the St. Lawrence on the night of April 22d, and the towns along the banks were seriously damaged, houses and embankments having been swept away and several lives lost. In New York State, along Black river and the lower part of Lake Ontario, the floods were very violent. Factories, tanneries, dams, and flumes were carried off. Near Watertown, a boom, restraining several acres of timber and flood wood, broke away from the chains, and carried off railroad bridges, mills, factories, furnaces, and machine shops. In the John Brown tract, the flood was caused by the breaking of a heavy dam, built to restrain the water of a series of lakes, and forming a feeder to the New York canals. Near Utica, the State dam, at a reservoir covering 500 acres, gave way, and the flood destroyed mills and other property valued at $100,000. On the Hudson and Mohawk rivers, the inundations have been very extensive, and the streets of Albany, Troy, and other cities in that vicinity, have been covered with water several feet deep.

WOOD ENGRAVING---ANCIENT PROCESS.

The exact origin of wood engraving is enveloped in considerable doubt; it is of very ancient date however, and the best authorities on the subject agree that it dates back some centuries anterior to the Christian era. It is useless to speculate upon fancied theories; for all practical purposes it is only necessary to present a skeleton review of the art, in its primitive days, or that portion of it that can be gleaned from reliable sources. Even this would be superfluous in this connection, except that it affords to practical mechanics, and those interested in the art, an opportunity of contrasting the means and appliances employed in the olden time, with those of our modern day.

According to the best authenticated authority, wood engraving, as an art, was first followed in (European countries) in Italy, about the middle of the fourteenth century, one of the early specimens of which is presented in Fig. 1, representing "The Knave of Bells."

This specimen is traced to one Antonio Carrigi, a manufacturer of playing cards in Venice, where, at this time, card playing as an amusement, and also for gambling purposes, was indulged in by the nobles and wealthy classes. These rude cuts were afterward painted in several gaudy colors with a pencil and sometimes ornamented with gilded borders. Although Carrigi may have been the first to follow the business of wood engraving in Europe, specimens of the art were occasionally met with that were supposed to have been executed many years previously; their exact origin never could be traced. For centuries anterior to this period, wood engraving was known to have been practiced as an art among the Chinese people, who have always been recognized as the most ingenious artisans in the world, in a number of the mechanic arts. The civilized or Christian nations, however, were not allowed to benefit by their ingenuity. An insurmountable barrier was ever interposed, precluding all communication with the outside world of the Chinese Empire.

China was not alone in giving birth to those works wherein mechanical skill was evinced at a very early period of the world's history. Late discoveries made in excavated catacombs in Egypt, and similar discoveries made amid the ruins of Herculaneum and Pompeii, also lead to the conclusion that wood engraving was known and practiced centuries before its new advent in Italy. It is therefore reasonable to suppose that with the decline and destruction of those countries, in which many of the higher branches of the mechanic arts, had reached the zenith of their perfection, they perished with them.

In historical annals there is a wide gap in their art records, a lapse of ages ere the skill and ingenuity of man is said to have revived and re-invented many of the arts, sciences, and manufactures, thus lost to mankind. Even tradition furnishes nothing but a faint glimmer of objects that lived and had their being in the past, and have left nothing to posterity but the wrecks and ruins of their former glories.

True, occasional relics reach us of the present day, affording a faint reflex of what once existed in the palmy days of this or that country, but they have served to gratify a passing curiosity only, or, it may be added, to stimulate the efforts of mechanical geniuses to reach even a higher scale of excellence.

The parchment scrolls lately excavated from mounds in the neighborhood of the Pyramids in Egypt, present many curious hieroglyphical and other characters which leave no room for doubt that the impressions were made from blocks of wood. It is impossible to fix a time when these were executed. In the same way with occasional specimens of a similar character, of Chinese origin, exhibited in cabinets and museums in European cities; their antiquity is simply a matter of speculation.

As we are cut off from any data previous to the fourteenth century, when wood engraving as an art was first adopted in Europe, we are compelled to accept the above theory.

In its application to books the earliest accounts that can be traced are in the first quarter of the fifteenth century, when engraving on wood was applied to the multiplication of copies of religious designs, which were at this period in demand among the people of Italy and Germany. This demand was created from the establishment of a number of monasteries and other religious institutions in these two countries, and a consequent demand for the reproduction of manuscripts of a devotional character. Strange to say, the demand for playing-cards, about the same time, led to the employment of a number of artisans who engaged in the business of wood engraving; religion and its antipodes, in this regard, being in perfect accord.

The story retailed by certain history manufacturers that the first wood engravings known in Europe were executed by a brother and sister of a noble fam ly of the name of Cunio, in 1285, representing the actions of Alexander the Great, is without the slightest foundation. Montague tells us that the sister, who had a talent for drawing, may have sketched some designs on tablets of wood, then used as slates are in our modern schools, representing in a crude form, Alexander in some of his heroic exploits; and that the brother may also have cut into the lines, thus drawn, with a stiletto or sharp instrument, as school boys are in the habit of cutting letters animals, etc., with their penknives, on walls, fences, etc. It was not until late in the fourteenth century that the Venitian merchants were allowed to have commercial intercourse with the inhabitants of China. It is fair to suppose therefore that in that part of Italy bordering on the Adriatic, specimens of wood engraving brought over from China by the trading argosies, were then seen for the first time. This agrees with the time when Carrigi is said to have inaugurated the art of wood engraving in Europe.

From this period until the middle of the fifteenth century rapid strides were made in perfecting the art and in making it available for business purposes. At first the demand was limited and confined to the religious orders. The representations of saints and other scriptural objects which the monks had for some centuries been in the habit of painting in their parchment Bibles and missals were by the early wood engravers copied in outline on wooden blocks, and divested of their brilliant colors and rich gilding, presented figures exceedingly rude in their want of proportion and not a little grotesque, from their constrained and ludicrous attitudes. But they were nevertheless highly popular, and as these crude pictures were accompanied with certain passages from scripture, they supplied the first inducement of the laity to learn to read, they being extremely ignorant at the time. There is no doubt that as crude and simple as these illustrations were, they assisted in a measure in preparing the way for that diffusion of knowledge which subsequently accompanied the invention of printing from movable types. Mankind however, are not indebted to religion, as previously remarked, for the introduction and application of wood engraving as an art, or a business vocation. Carrigi and his playing cards undoubtedly have the precedence, and called forth the art of the limner and the engraver long before religion stepped in to as a foil neutralize the bad effects they were producing upon the noble and the wealthy classes of Venice. Gambling, like many other vices and follies, is an heir loom that descends from the great to those below them in the social scale. It is easy therefore, to understand that the followers of courts and camps, as well as the artisans and dealers in the towns, seeing the amusement which their superiors derived from these bits of stout parchment, would be anxious to possess the same means of pleasurable excitement in their hours of idleness. In this way the demand for playing cards increased so rapidly that other engravers beside Carrigi entered the field, and for some time a thriving business was done in supplying not only the home demand, but for export to other countries.

Wood engravers were subsequently employed in getting up illustrations for books. The first specimen of any note of this kind is in the collection of the late Earl Spencer. It is a curious cut taken from a wooden block, representing St. Christopher carrying the infant Savior. This work bears date 1423. If not the first specimen of the art of line engraving, it is the earliest undoubted document which determines with precision the period when wood engraving was generally applied to books, and objects of a devotional character.

In a very few years after the period above named, the art of wood engraving reached a more important object: viz., that of aiding in popularizing books of instruction. Up to this time Bibles were written on parchment and could only be obtained at a fabulous cost. It was then thought that a selection of subjects from the Bible with appropriate illustrations, both engraved on wood, might be acceptable to the common people. Such a book was produced in the year 1440, and was called "Biblia Pauperum"—the Bible of the poor. This very rare book consisted of forty leaves of small folio, each of which contained a small wood cut with extracts from the scriptures and other religious authorities. This was followed by other works of a similar character, the most remarkable of which is called "Speculum Salutis"—the Mirror of Salvation. In this performance the explanation of the texts are much fuller than in the work previously named. In this work the illustrations and the texts are printed from wooden blocks. In addition to these religious works wooden blocks were also used to print small manuals of grammar, called "Donatuses," which were used in schools. From this period the art of engraving on wood gradually merged into the art of printing from movable types. The early printers, imitating the manuscript books upon papyrus and parchment, used largely wood engravings of initial letters, and at times the pages of their works were adorned with wood-cut borders and frontispiece illustrations. At this period if a figure or group of figures were introduced, little more than the mere outline was attempted.

In the "*Historiæ Veteris et Novi Testamenti*," published about this time, a number of wood-cut illustrations appeared in it, the one in the frontispiece is especially note-worthy from the fact that a better class of wood engraving, in which gradations of light and shade, and the light hatching dots subsequently used, were represented. Mr. Ottley, in his "Early History of Engraving" tells us that an engraver on wood named Wohlgemuth, who flourished in Nuremburg, in 1480, first succeeded in imitating the bold hatchings of a pen drawing, on wood. Subsequently Albert Durer, became the pupil of Wohlgemuth; and by him and later by Holbein (both artists of note) wood-engraving was carried to a perfection, which it subsequently lost until its renewal in England by Bewick. For a century and a half, however, after the above named period, wood cuts were profusely employed in the illustration of books in Italy, Holland, France, Germany and England. Two of these early works, published in England, viz., "Hollingshed's Chronicles," and "Fox's Book of Martyrs," clearly attest how instructive and amusing illustrated works were considered even at that early day.

The gradual diffusion of knowledge and the consequent increased demand for books among the nobles and wealthy classes, led to a more costly style of embellishments than the crude wood-cuts then in use. This demand of the wealthy classes led to the discovery of engraving on copper plates. Sir John Harrington's translation of "Orlando Furioso," published in 1690, was the first English work in which copper plate engravings were used. From this time until the latter part of the eighteenth century the use of wood cuts gradually declined; that is to say, that as a high branch of art, wood engraving was almost entirely lost, until the appearance of Bewick, an ingenious artisan, who prosecuted his business at Newcastle-upon-Tyne. His cuts of quadrupeds and birds are as remarkable for their force and delicacy of execution as engravings, as for the vigor and accuracy with which he drew them; and his humorous vignettes possess a truth of character which has been seldom equaled. The success of Bewick created a number of artists in wood engraving, but until the last half century the art was not applied to its legitimate purpose, which is the art of design naturally associated with cheap and rapid printing.

The wood engravers, who were contemporary with and immediately succeeded Bewick, were generally employed in the illustration of the most costly works, the introduction of the cuts often rendering the printing of the other portion of the book so expensive, that volumes thus embellished were as costly as though they had been printed from metal plates. The cause of this was simply because these engravers employed a certain method in working their blocks, requiring extraordinary care in the impressions after the engravings were executed, and the wood cuts being included in the same page and sheet with the text, even though a single wood cut appeared on a sheet, the attention it demanded from the pressman prevented the rapid working off of the other pages, thus compelling a great waste of time.

Correspondence.

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

Expanding Steam—Test of Engines.

MESSRS. EDITORS:—On page 197, of your current volume, I criticised the claims of certain steam engine builders by comparing their pretentions with some of the known laws of mechanics. These builders claimed, that in working steam at 60 pounds pressure in their engines, it expanded to 16 volumes, and still retained a pressure of 3 pounds, and showed diagrams of cards to prove the claim. I asserted that no such card could have been fairly taken from any engine, under the conditions claimed. From the editorial remarks upon that communication, it is evident that you understand me to have deduced those conditions from the diagram. This is not strange. But how your correspondent, on page 280, who claims to speak for those builders, and is, of course, familiar with their circular, could honestly think that the figures I gave of the amount of steam admitted to the cylinder, were obtained by estimate from the card, is a little more wonderful.

The truth is, I made no *estimate* whatever, of the amount of steam admitted, nor of the power obtained; but took both from the positive statements of the circular. It is there *stated* that "steam enters the clyinder at 60 pounds, and follows only 1¼ inches, and is instantly cut off." Again, (I quote from the circular), "thus we have the area of a 12-inch cylinder, which is 113 inches by 1½—169·50 inches of steam to move the piston from one end of the cylinder to the other." And again, "steam striking the piston at 60 pounds, and falling to the 3 pounds at the end of the stroke, gives us an average pressure of 17½ pounds, the entire length of the cylinder, requiring *only* 169½ cubic inches of steam."

It was the above conditions that I asserted could never be ealized by any engine.

Your Utica correspondent, forgetting these statements, very kindly informs us, that it is an error to suppose "the amount of steam used is measured by that admitted to the cylinder up to the point of cut-off," that "it is the volume of steam in the cylinder, at the opening of the exhaust valve, which determines the quantity of heat required to do the work." Could this important truth have been discovered by the parties who publish the circular in question, before analyzing their own diagram, what a difference it would have made in their figures! Their cylinder contains, at end of stroke, 2,712 cubic inches of steam, of 3 pounds pressure, by the gage. This, if admitted at 60 pounds, could not, with the smallest possible allowance for attenuation, have expanded to more than four volumes, so that, in place of using only 169½ cubic inches, as they assert, we have, by this rule, at least 678 inches

Here is a slight difference in figures, but perhaps it may be of no consequence to your correspondent, as he proposes to disregard some other matters of importance. He says, "The item of units of heat lost in developing power may be disregarded, or rather only regarded generally along with other losses, of which the indicator takes no note, such as leakage of piston and exhaust valve, condensation, etc."

Now, it is true that leakage of piston, and valves, and condensation, are not considered in the *theory* of expansion, but the assertion that, in *practice*, they are taken no note of by the indicator, will certainly be received with surprise. And as to the heat lost in developing power, either the theory that disregards it is false, and the indicator that fails to note it unreliable, or the whole doctrine of the correlation of forces is untrue; for, according to that doctrine, the heat lost must be the equivalent of all the power utilized by expansion.

The writer complains that "the card published in the SCIENTIFIC AMERICAN is not exactly a reduced copy of the one in the circular," that "the compression curve" is not made by lead of steam valve, and that the card shows a "negative steam lead," etc. It is true this card is slightly inaccurate, but is rather nearer to the *described card* in the circular, than their own diagram. As to the "compression curve" and the "negative steam lead," every engineer knows that by closing the exhaust valve early and compressing the steam remaining in the cylinder, the pressure will rise at the end of the stroke, independent of the opening of the steam port; but that this pressure will continue to rise, "the steam valve not opening until the piston has moved some little distance on its forward stroke," is a discovery for which science must be greatly indebted to your Utica correspondent.

Now, a word on the practical side of the question: Mr. J. H. Fountain, of Elmira, N. Y., has, in his flouring mills, at that place, one of those "short cut-off" engines, which was warranted by the sanguine builder to save 40 per cent of fuel over any single slide valve engine. A test was was by the builder, of a ten hours run, which was satisfactory to himself, but not to Mr. F., who has since put in a small slide valve engine. This he did for the purpose of making a careful test. Under date of April 4th, he writes me as follows: "We tested the slide valve engine last week, on a ten hours run, with the same kind of grain and fuel as with the engine that was to save 40 per cent of fuel, and the slide valve ground *more grain*, and with *less fuel* than the other, saving just twelve per cent from the amount used by the short cut-off. The small one, too, worked to great disadvantage, as it was set on light timbers, in a temporary manner *geared* to the shaft of the other, and with a long steam pipe to it. Mr. —— (the builder), on making a test personally, with his engine, pronounces it as good a result as he ever knew, yet it is badly beaten by this country made engine." . . . Mr. F. also says, that the short cut-off gives an irregular motion, jamming the machinery, loosening the irons in the stones, the toes of the spindles, etc., which might be expected as a natural result, where the initiatory pressure is high and the final pressure a partial vacuum.

Keokuk, Iowa. E. S. WICKLIN.

Cheap Gas.

MESSRS. EDITORS:—In reply to the writer of the article "Cheap Gas," page 295, current volume, of the SCIENTIFIC AMERICAN, who signs P. W. K., and criticises some of the statements made by me in a previous communication. I simply wish to remark, that never having personally made the subject of transmission of gas through mains a speciality, I employed for my calculations formulæ given by some of the best modern gas engineers, such as Clegg, Pole, d'Harcourt, Hughes, etc., in their published works. I was fully aware that further experiments in this direction were much needed, and think that P. W. K. would supply a desideratum by favoring the SCIENTIFIC AMERICAN with the result of his studies on this important question.

When, however, he affirms that he can carry carbureted hydrogen gas through mains a distance of 200 miles with a loss of less than 5 per cent by leakage, I cannot help expressing skepticism, since it is a well-known fact to all persons interested in gas works, that a larger amount of gas then that stated is actually wasted every day in the best constructed mains, and this on a stretch of five or six miles only; not simply by leakage at the joints, but by a remarkable phenomenon of direct penetration of the very substance of the pipes, analogous, if not identical, with dialysis, during which a certain portion of air is substituted for the escaped gas.

What I attempted to prove, was that bringing gas from the coal regions to New York through mains, would not cheapen it to the consumer, and would not be conducive of profit to the producer. This, I again affirm, notwithstanding what P. W. K. may say to the contrary. Supposing the plan a feasible one under his management, and at his own figures of $32,000,000, we see that the very interest on this sum of money would amount annually to no less than $2,275-000, or very nearly the present amount paid for freight on coals, leaving but a very small margin for the eventualities of such a venturous enterprise, or on which to base a reduction in the price of gas.

It would prove quite as profitable, and, I cannot help but believing, considerably safer, to place the "goodly" millions in a well-managed bank, and to continue, as heretofore, to pay freight on coal out of their accumulated interest.

I am, personally, a firm believer in the theory of the necessity of the "division of labor," and in the great principle of "live and let live," whether it be applied to the builders of our railroads, to the makers of our gas, or to the "illuminated" masses in general, whose own fault it is, if, in this free country of ours, through the choice of their representatives, they are imposed upon by monopolies.

Reduced freights, and a little more conscientiousness on the part of the gas companies, are all the consumer in this great metropolis calls for at present.

When P. W. K. has successfully put his project into operation, I shall be the very first to cry out *mea culpa*, especially if he thereby diminishes my present gas bill 50 per cent, as he promises to do, but until then, he must excuse me for dissenting from his views. X. Y. Z.

[Our correspondent is right. We consider it entirely impracticable, at the present time, to manufacture gas at the mines and conduct it through pipes to distant cities.—EDS.

Calculating Horse-power of Engines.

MESSRS. EDITORS:—I notice an article under the above caption, on page 278, No. 18, current volume of the SCIENTIFIC AMERICAN, which is so manifestly crude and fallacious that, to prevent those who are not thoroughly posted on steam and steam engines from being misled, I offer you this note; not, however, that I expect that your correspondent will be converted, for he is an "old hand," and it is not expected that he will learn "new tricks," especially as he is so unfortunate as to find a scientific engineer with such an unfortunate rule.

Now let us look at a comparison of the two engines. The one 14 by 26 inches, 80 revolutions per minute, 346·4 feet; the other, 8 by 12, 450 revolutions per minute, 900 feet.

According to the old hand's theory, they are, respectively, thus: the 8 by 12 is equal to 28-horse power, the 14 by 26 is 33·33-horse power. Now, then, let us see what power they do absolutely exert to move themselves and the load or resistance attached. In making the calculation we will take the "Old Hand's" own data, so far as the elements required are put down; viz., the diameter, stroke, revolutions per minute, and pressure of steam on the piston. Of course an "old hand" would give the pressure on the piston, right from his good opportunities for observation, though he don't believe in textbooks, or even the SCIENTIFIC AMERICAN! Give him the power of the 8 by 12, with 56 lbs. pressure per square inch on the piston, the resistance overcome would be 76·72-horse power. The 14 by 26 would be 89·26.

Perhaps, before he writes another article on the subject, it might be well for him to ascertain what constitutes a horse power, as known and used by engineers. If he finds it to be a given weight raised through a given space in a given time, he then can very easily find what pressure is required to do it, and will thereby learn that it is simply weighing, and measuring—the alphabet of engineering.

Now the discrepancy between the "rule of thumb" and the true rule, as above described, is a little too large for me to believe. "Twenty years' experience and good opportunities" are unfortunately at conflict with Gunter's rule and Fairbank's scale. ENGINEER.

The Dynamical Lever.

MESSRS. EDITORS:—It appears to me that some of your correspondents have given the "dynamical lever" credit for effects which it has no agency in producing.

A correspondent in No. 19, current volume, page 277 of your paper, conceives that the fact that a horse can move, on a wheeled vehicle, 2,500 lbs. at the rate of 176 feet per minute (equal to 440,000 lbs, one foot per minute), while "the average capacity or power of a horse is 33,000 foot-pounds," is due to some magical power of the "dynamical lever."

Now, a horse can move, in a canal boat, a great deal more than 2,500 lbs. at the rate of 176 feet per minute, without the aid of wheels, or any other form of "dynamical lever." How will your correspondent account for this? His error consists in not recognizing the fact, that the moving of a ponderous body upon a horizontal line and on a vertical line are not precisely the same thing.

Again, this correspondent thinks, that the fact that a horse can move a heavier load, at the same speed, on a cart with large wheels than with small ones is due to the mysterious virtues of the "dynamical lever." In this he is mistaken. The fact is due to a difference of friction between the axle and the hub.

To illustrate: Suppose you have a load of 2,000 lbs. on a cart. It is manifest that at every revolution of the wheels, whether large or small, you will have to overcome the friction due to 2,000 lbs. weight on the bearings of the axle in the hub. If the cart has wheels 6 feet in circumference, to move it 60 feet you must overcome the friction of 10 revolutions; but if wheels, 12 feet in circumference, to move it 60 feet, you will only have to overcome the friction of 5 revolutions. In other words, by doubling the circumference of the wheels, you reduce the friction one-half. And this is the only reason why a horse can draw, on a level plain, a heavier load, at the same speed, on large wheels than on small ones.

J. J. C.

[With this letter we shut down on this dynamical lever discussion. Our first correspondent, F. R. P., has been so clearly in the wrong throughout the entire discussion that any further demonstration of his error is unnecessary. We therefore wish no further communications upon this subject. If any of our readers should see fit to criticise the views of J. J. C. in regard to the origin of the gain in the use of large wheels on draft vehicles, there is room for some profitable discussion on that point.—EDS.

Required Power for Velocities.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN, of May 1, page 278, are several communications on the above subject. One from "F. R. P.," on his dynamical theory, to which it is hopeless and useless to reply. "Wm. Horsnell" overlooks the reduced load to the engine of one-half (so considered) when disconnected—thence, requiring only half pressure of steam for equal revolutions—but giving double with same amount of steam. "A. Dean" is laboring under a fundamental error in supposing a double velocity does not require a quadruple force. The pendulum exhibits this law very clearly. Its vibrations, whether of number or size, are dependent on the force (gravity) acting on the disk. A quadruple force is requisite to double the number, or to double their size respectively.

The usual estimate of vibrations by the square root of the length of the rod (inversely) is correct, but is merely incidental to the governing force of gravity, the weight sustaining action of the rod, taking off the gravitating force in the above ratio. Mr. Dean correctly states that in practice there is a loss not taken into account by the leading features of increasing velocities—the main loss would be in additional slip to the paddle or screw—inversely as the square root of the power applied, for the water, in conformity to the foregoing law, requiring a quadruple force to give way, or slip a double distance. Mr. Dean maintains that resistance is as the distance, without regard to time of making it; if it were so, a bluff-built vessel would be as easily propelled as one of sharp lines, for the midship sections is the measure of the water displaced in either case. T. W. B.

Pittsburgh, Pa.

Facts vs. Philosophy—Hot Air.

MESSRS. EDITORS:—In your issue of April 24, is a labored article on the "Heating of Buildings." Much might be said to show its unsoundness, on its own basis, but I shall be content now with giving facts.

For more than twenty-five years we have lived in a stone house warmed by a hot-air furnace. The house has been kept warm, or even hot, night and day. We have raised a family of eight children, four of each sex. My wife is rather a feeble woman. Twenty-five years ago I weighed 145 lbs.; now weigh 225 lbs. Our doctor's bill has not been one hundred dollars for the twenty-five years. We have had no death in the family, our children are all vigorous and healthy. More than half of them have left home and settled in different States in the Union. Our family have suffered less with colds, and other kindred complaints, than almost any other family. If this is "destroying health and comfort" please give us more of it.

I know of many other families whose houses are heated by hot-air furnaces, who will testify to their great utility and comfort. Let doctors philosophize, the people are bound to live on. G. W. H.

Lockport, N. Y

[The logic of facts is hard to withstand, and if the cases cited by our correspondent were the only facts bearing upon this subject, we should have to admit that he had made out a fair case for the heaters. He has cited us a few cases where people have enjoyed good health and got fat, notwithstanding the heaters. We could cite many more where their deleterious effects were quite as obvious. His wife, he says, is in feeble health. Has it ever occurred to our correspondent, considering the difference in people's constitutions, and the other significant fact that she is more exposed to the injurious effects of the heated air, that possibly the heaters are the cause of her debility?—EDS.

Taps Cutting Varying Threads.

MESSRS. EDITORS:—Is it a possible thing for a nut to be cut with a tap of a given number of threads other than the treads on the tap?

I have a tap that in the hands of an unskillful workman cut some three-quarter inch nuts in a manner that I cannot understand. The tap is a machine one that goes through the nut and leaves it on the shank. It cuts ten threads to the inch. He cut some of them correctly, the tap going through the nut in about forty revolutions. Those that were cut wrong were cut in about ten revolutions of the tap, it making five entrances to the nut, instead of one, as it should have done. W. H. K.

[We have often been puzzled with the difficulty alluded to by our correspondent, but never with a machine tap. We never could account for it, nor understand the "reason why." It is usually attributed either to defect in the tap or in the hole to be threaded, but this hypothesis is not sustained by the facts. An explanation from an observant mechanic would be well received.—EDS.

Fall of a Smoke Stack.

MESSRS. EDITORS:—A short time ago the smoke stack, or chimney, of the flouring mill of Read & Bottom, of this place, fell, causing the entire destruction of the mill. The building was of brick, and the chimney fell across it, smashing walls, machinery, and everything before it. The cause of the fall appears to be the softening of the brick by the steam from the escape pipe, which had been turned into the chimney. The escape pipe was let into the chimney near its base, and at this point the brick could be crushed between the fingers, while the balance of the chimney was perfectly solid. As others may be allowing their exhaust to pass into their chimneys, it might be well to sound a note of warning.

Fairfield, Iowa. WM. LOUDEN.

Machinery not Hostile to Mental Culture.

The *North British Review*, in discussing the essays of Matthew Arnold, upon "Culture and Anarchy," thus disposes of that gentleman's assertions relative to the hostility of machinery to the highest culture of mankind.

"We cannot think that human nature, in finding an outlet for its many-sided activity in the direction of 'machinery,' acts in a way that is hostile to culture. We prefer (as in the case of religion) to include the practical tendency which finds scope in new inventions to accelerate labor, and to supersede manual toil by mechanical contrivance, within the sphere of culture. Let it be admitted, that it is intrinsically of much lower value than any other kind of effort, bearing on the perfection of the individual. Still, as it implies the victory of man over Nature, insight into her laws, and the utilization of her processes, it is the condition of other and higher grades of culture; and inasmuch as it is a virtual necessity of human life, let us concede its value and respect its tendency."

Diamond Turning Tool for Vulcanized Rubber and Emery Wheels.

We desire to call attention to the advertisement of the New York Belting and Packing Company, on the last page of this issue, of a new diamond-pointed turning tool for trueing up vulcanized rubber and emery wheels. The trueing up of these wheels by heating their perimeters to soften them during the operation of turning, as has hitherto been the practice, was liable to leave their surfaces in a softened and friable condition, unless the heat was carefully regulated during the process. One of these new tools will turn up a wheel eight inches in diameter, and having a face one and one-fourth inches wide, from three to four hundred times, leaving the surface in the best condition for work. The turning can be quickly and easily done without heat or other aid to the action of the tool. The objections which have hitherto been made to the use of these wheels for certain kinds of work, seem completely obviated by this invention.

The Law of Steam.

BY J. DEBY, C. E.

Calling P the pressure of steam in atmospheres; A the latent heat in steam of atmospheric pressure (537 deg. C., equal to 966·6 deg. Fah.); L the latent heat in steam of any other given pressure, in atmospheres; *b* a constant number (which for Cent. scale is 17, and for Fah. scale 30·6); T the Cent. temperature of steam, and T' its Fah. temperature; V its relative volume to water, and S its specific gravity, we see that *for every decrease in the latent heat of steam equal to* 17 *Cent* units, or 30·6 Fah., *there corresponds a doubling of the pressure*; *a decrease in volume*, equivalent to the number of times, minus one, that the number 17 is contained in this decrease of latent heat; *an increase in weight* equal to the number of times, minus one, that the number 17 is contained in the decrease of latent heat; *an increase in specific gravity* equal to 0·00059; and an *increase in sensible heat*, equal to 24·4 Cent. or 35·92 Fah.

If P—1, then L—537; T—100 C.; V—1696; W—62·32÷1696; S—1÷1696.

If P—2, then L—537—17; T—100 + 24·4; V—1696÷2; W—62·32÷(1696÷2); S—1÷(1696÷2).

If P—4, then L—537—(2 × 17); T—100 + (2 × 24·4); V—1696÷3; W—62·32÷(1696÷3); S—1÷(1696÷3).

All the above are derived from a law, which we now announce as follows: *The pressure of steam increases in a geometrical progression*, the terms of which are multiples of two, as 1, 2, 4 8, 16, 32, etc., *while the latent heat decreases in a compound arithmetical progression*, the constant of which is 17 Cent. or 30·6 Fah., and the multipliers, respectively, as the numbers 0, 1, 2, 3, 4, 5, etc.

Machine for Making Drain Tile.

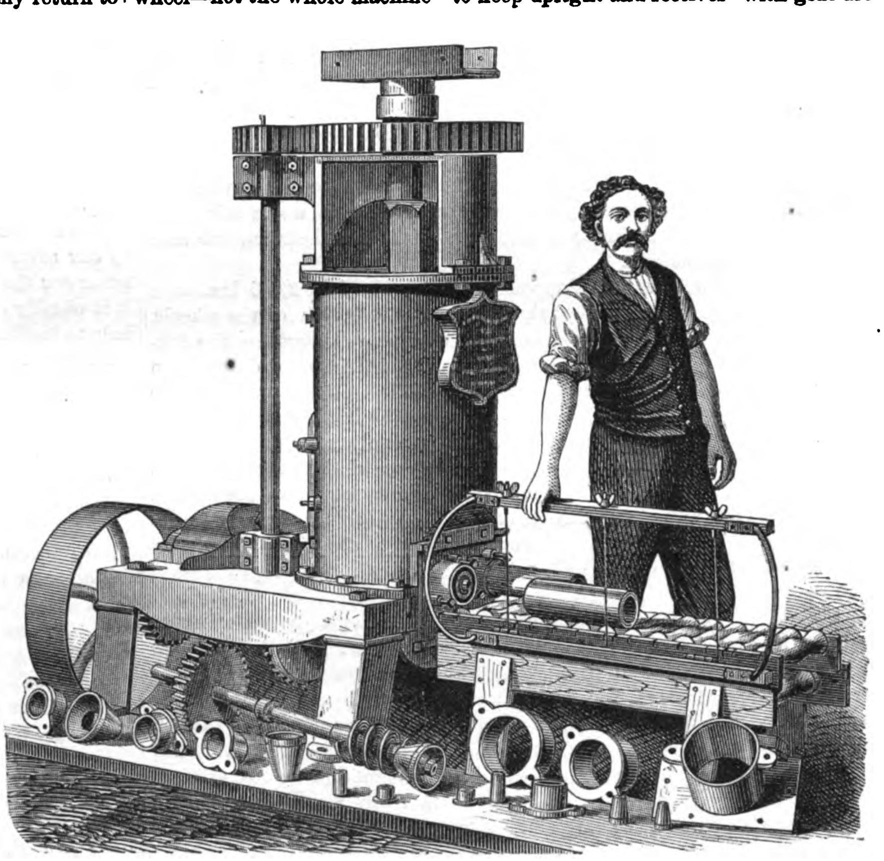
It is only a few years since draining lands by means of tiles was considered an experiment expensive in its operation and doubtful in its results. That period of doubt is past; and now tile draining is known to be a paying department of agriculture, not only for cultivated and arable lands, but for those which otherwise, from natural sourness, refuse to yield any return to the labors of the agriculturist. Any means, therefore, that facilitates the production and lessens the cost of drain tile is worthy of encouragement.

The engraving shows a machine for making drain tile, consisting of a "pug mill," having the usual curved knives, or arms, for disintegrating the clay, a screw-follower for carrying and forcing the prepared clay into the dies, and a series of dies or formers to give size and shape to the tile. This screw follower and an assortment of dies are seen in the foreground of the engraving.

In front of the die-openings is a bench containing a set of rollers, the surfaces of which are hollowed to receive the pipes as they come from the formers, and the operator, by means of a hinged frame furnished with cross wires, cuts the continuous pipe into proper lengths, while another attendant removes them to the kiln.

The blades of the pug mill reduce the mass of clay to a plastic condition, and the lowest series of blades are simply semicircular disks set spirally on the upright shaft, forcing the material on to the conveying horizontal shaft, furnished with a continuous spiral blade and a cone-shaped former turning within the fixed die. The continuous screw forces the doughy mass through the dies on to the rollers of the bench, where the fully-formed pipes are cut to convenient lengths by the hinged frame with its cutting wires. The rapidity of production of the machine is limited only by the alacrity of the attendants in taking away the sections (the mill being kept well supplied with material).

Patented through the Scientific American Patent Agency Oct. 4, 1859, and Feb. 26, 1861. Orders for Eastern, Middle, and Southern States should be addressed to Crossman Clay and Manufacturing Co., Woodbridge, N. J. For Western territory, address H. Brewer & Son, Tecumseh, Mich.



TIFFANY'S PATENT DRAIN-TILE MACHINE.

Improved Three-Wheeled Velocipede.

Probably the greatest objection to the three-wheeled velocipede, as ordinarily constructed, is not that it is larger than the bicycle or that it requires a greater exercise of power to propel it, but that every motion of the rear axle, when either of its wheels passes over an obstacle, is conveyed directly to the seat and to the body of the rider, so that there is a constant pitching to the right or left, which is wearisome to the rider and prevents that graceful motion that constitutes half the charm of the exercise to the operator and attraction to the spectator. Another difficulty in the ordinary "three-wheelers" is inability to turn short corners. The rigidity of the machine prevents any tipping or leaning of the body of the rider and the machine itself, that is as requisite in riding the velocipede in a circle or around a curve, as though the rider was mounted on a horse careering around the circus ring, or on skates "cutting a figure eight." It is evident, therefore, if these objections can be removed and if the tricycle possess the ease of guiding and grace of action of the bicycle, it will, in many cases, where safety is preferred to daring, be chosen. The inventor of the improvement shown in the accompanying illustrations thinks he has succeeded in this object.

The improvement consists in the manner of connecting the forward or driving wheel with the rear axle by means of the reach, which is a hollow pipe, combining strength and lightlightness, or of round iron. On the front this connecting bar or reach is curved to the circumference of the forward wheel, then brought to a level, and running back to the center of the rear axle in direct line with the forward wheel and at the level of the axle. A sleeve, in which the reach turns, embraces it forward of the axle, to which it is secured by diagonal braces, as seen in Fig. 1. Directly over the rear axle, the end of the reach is secured to a cross bar, A, and a spring, B, Fig. 2, the ends of the latter resting on the axle. As the rider leans one way or the other, and the forward or guiding wheel is directed, the bar and spring are brought down to the axle, as seen plainly in the dotted lines of Fig. 2.

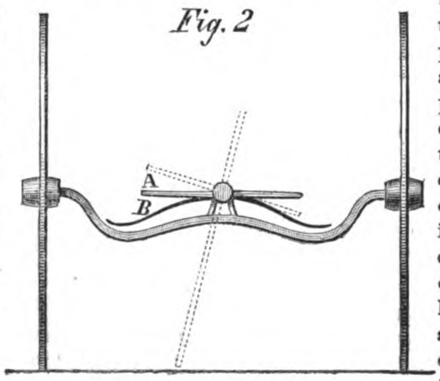
Thus the tipping or lifting motion of either forward or rear wheels is independent of each other.. The bar prevents too great an action of the spring, while the rider is not compelled to exert his force or employ his weight to direct the rear wheels. In applying the power the ends of the fork that holds and guides the driving wheel extend below the axle, and a light steel frame is secured to studs projecting from the lower ends of the fork and to the ends of a yoke forming part of the fork directly over the wheel. In this steel frame there is a slide on either side to which the crank is connected, and also the treadles. The steering bar is of the usual form. The action of the slides is aided and the friction reduced by rollers; the stirrup, or treadle is adjustable to the length of limb of the rider. The feet have simply a direct up and down motion, not describing a circle, thus enabling the vehicle to be driven more rapidly with the same amount of motion of the feet. The inventor says that as the rider has only one wheel—not the whole machine—to keep upright and receives considerable assistance from the spring, it is a much easier machine to ride than the bicycle; as short a turn can be made with it, a slower motion sustained, and less chance for accident, as it cannot be overturned, and it is suitable for children and inexperienced persons.

Invented and patented by W. S. Hill, Manchester, N. H., through the Scientific American Patent Agency, April 13, 1869. The entire right is for sale. Address as above.

Fig. 1.

HILL'S PATENT TRICYCLE.

Fig. 2



Chair Wanted.

The *American Builder* anxiously asks: "Will somebody tell us where we can buy a chair? We want an office chair, a parlor chair, a dining-room chair, and a kitchen chair. We have experimented in chairs for a number of years, and always with the same results. They prove the wickedness of men who, in these degenerate days, make things to sell.

"Now, if there is any thing in the world built for the use of an American citizen which should be built in a substantial manner, that thing is a chair. It should be so constructed as to sustain a weight of two hundred pounds avoirdupois, on four legs, two legs, or one leg. As these very necessary articles of furniture are now constructed, they will not stand alone any considerable length of time in a room heated to a comfortable degree of temperature. The worthless glue with which they are stuck together thaws out, and then they fall in pieces. Some years ago we purchased of a highly reputable dealer—among the most reputable of his class, we mean—what we considered a very substantial as well as high-priced set of office chairs. They were in pieces in less than a month, and the reputable dealer's tinker was called upon, week after week, to pay them his attentions. But the tinker, with his glue pot, failed; whereupon we called in a son of Vulcan, who substituted iron in the place of glue, and with astonishing success. Subsequently, having occasion to purchase a set of office chairs, we thought to profit by our former experience, and, remembering the splint-bottomed arm-chair of our grandfather, which never broke down, we searched the city for duplicates. We found them after many hours' search. Alas these too were like the others; they commenced coming to pieces within a fortnight.

"We have arrived at the conclusion that chairs put together with glue are worthless. Now, will not some inventor give us a chair? We incline to the belief that a fortune is awaiting the man who will devise a method for putting together chairs in such a way that glue shall be dispensed with entirely."

The Crow's Value to the Farmer.

Whatever wrong the crow commits against the cultivators of the soil may, by a little painstaking, be materially lessened or wholly prevented. The benefits he confers are both numerous and important. During the time he remains with us he destroys, so says no less an authority than Wilson, "myriads of worms, moles, mice, caterpillars, grubs, and beetles." Audubon also affirms that the crow devours myriads of grubs every day of the year—grubs which would lay waste the farmer's fields—and destroys quadrupeds innumerable, every one of which is an enemy to his poultry and his flocks. Dr. Harris also, one of the most faithful and accurate observers, in speaking of the fearful ravages sometimes wrought in our grass lands and gardens by the grub of the May beetles, adds his testimony to the great services rendered by the crow in keeping these pests in check. Yet here in Massachusetts, regardless of such testimony in their favor, we have nearly exterminated these birds, and the destructive grubs, having no longer this active enemy to restrict their growth, are year by year increasing with a fearful persistence. We have seen large farms, within an hour's ride of Boston, in which, over entire acres, the grass was so completely undermined and the roots eaten away, that the loosened turf could be rolled up as easily as if it had been cut by the turfing spade. In the same neighborhood whole fields of corn, potatoes, and almost every kind of garden vegetable, had been eaten at the root and destroyed. Our more intelligent farmers, who have carefully studied out the cause of this unusual insect growth, have satisfied themselves that it is the legitimate result, the natural and inevitable consequence, of our own acts. Our short-sighted and murderous warfare upon the crow has interrupted the harmonies of Nature, disturbed her well-adjusted balance, and let loose upon agriculture its enemies with no adequate means of arresting their general increase.—*Atlantic Monthly.*

Recommencement of the Excavations at Herculaneum.

All those who take an interest in antiquarian studies, says the *Eclectic*, will rejoice to hear that, after a century of almost total neglect, the excavations at Herculaneum are now to be resumed, King Victor Emmanuel having conceived, or at all events carried out, the happy idea of assigning for this purpose an annual grant of thirty thousand francs to the charge of his civil list. He has, furthermore, undertaken to provide for the maintenance of a pupil at the Archæological School of Pompeii. These measures have been received with uncommon satisfaction in the Neapolitan provinces. As befitted an event of such importance as the recommencement of the long-abandoned excavations at Herculaneum, the opening ceremony was directed, and the first clod loosened by the king himself. What a rich harvest of discovery may reward the toil of future laborers in this mysterious soil! What further insight into the domestic life of the ancient world may not be obtained from the imprisoned treasures that have at last obtained their orders of release! The two buried sisters, Herculaneum and Pompeii, have undergone a very different fate in these latter times. The earliest researches were instituted in Herculaneum with magnificent results; but partly from the hardness of the material in which the ruins are imbedded, and partly also from a fear of endangering the foundations of the modern town of Portici, the works were discontinued and transferred to Pompeii, where the labor is far easier, and, therefore, more remunerative. As a set-off against this defect, the works of art unearthed here are generally of a superior character, not only because Herculaneum was itself a seat of a richer and more refined community, but also because the difficulties attending the excavations at Herculaneum have preserved its contents from the depredations to which Pompeii has been subjected at various periods.

WE understand that extensive preparations are making at Lowell, Mass., to test the powers of turbine wheels by an entirely new method, the test to take place about the middle of May. The precise day is not yet fixed.

Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Company," Agents, 121 Nassau street, New York.
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VOL. XX., No. 20...[New Series.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY, MAY 15, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

A REFORMATION IN THE PATENT OFFICE.

Secretary Cox enjoys the reputation of being a patriotic and incorruptible man. He has certainly given earnest proof of the possession of these sterling qualities by breaking up the villainous rings that so completely demoralized the service of the Indian Bureau.

In the selection, also, of Col. Fisher to occupy the important position of Commissioner of Patents, we are still further assured that Secretary Cox intends to put an end to imbecility and corruption in the management of the affairs of that Office. It has come to pass, somehow, that the Patent Office has fallen under suspicion. The misappropriation of the funds of the Office in barbaric decorations, Dempsey & O'Toole contracts, and other transactions of a somewhat doubtful character, served to justify Congressional interference. But worse even than these things is the current impression that the Patent Office had fallen into the hands of a corrupt clique who molded the decisions of the Office to suit their own interests. We cannot say that this suspicion was justly founded, but we do know that its general influence upon the character of the Office has been pernicious in the extreme. It is also well known that certain parties about the Patent Office have hitherto been too much in the habit of claiming a sort of paternity to the Commissioners, as if they were merely creatures of their breath. This may have been merely a vain and innocent conceit; but such things tend to degrade the character of the Commissioner of Patents and expose him to unjust suspicion.

Col. Fisher is indebted to none of these parties for the position he now holds. It is well understood that other candidates were urged by them, they knowing probably full well that should Col. Fisher get the appointment he would be fully competent to undertake all the duties of the Office without their intrusive advice, and moreover his character was a sufficient guaranty that corrupt rings could not bind his independent action. We feel encouraged, therefore, that brighter days are in store for the Patent Office, and that the new Commissioner will fully justify the confidence reposed in him.

THE SALE OF GAS BY QUALITY AS WELL AS QUANTITY.

We notice that the absurdity of selling gas by measure merely without regard to its quality, to which we called attention in an article on "Gas Measurement," nearly a year ago, has begun to attract notice both in this country and in Europe. *Engineering*, of April 9th, contains an able editorial on this subject, in which it almost reiterates the very language we used in the article referred to. It says: "There seems to be a very general opinion on the part of gas consumers that they should have some readily accessible certification of the quality of gas in regard to illuminating power and purity; and that since the supply of this lighting material is virtually a monopoly, the relations between the price paid for it and the qualities above mentioned, should be regulated in such a manner that the consumer might obtain a fair equivalent for his money, while the gas companies would be secured a reasonable interest on the capital and expenditure necessary for their operations."

It is evident that if the gas delivered to customers be of uniform chemical composition, and be delivered under uniform conditions of pressure, its illuminating power will be uniform. These conditions can be only approximated in practice, but there are certain limits beyond which no variation ought to be tolerated.

A photometric test is one which is out of the question for universal use. Beside requiring personal attention at every application, there is no unit of measurement that can be relied upon as being uniform. Candles vary widely in their illuminating power, and the oil lamp of Keates, recently invented for photometric use, seems to us far from perfect. There is also a necessity for the proper adjustment of burners to the quality of the gas in photometric tests. No test made with a single burner is reliable. Poor gas will flow far more freely through a small aperture than rich gas, and as the flow is intimately connected with the pressure, and the pressure with the illuminating power, the necessity for repeated tests with different burners becomes obvious. These considerations show that this kind of testing can never be made available to consumers at large.

We believe a specific gravity test cannot be made applicable to the obtaining of approximate results as to the illuminating power, and the determination of those gases which are detrimental to the illuminating power of the complex mixture of hydrocarbons which constitute illuminating gas.

We speak of this here because it has been proposed several times of late, by inventors not fully acquainted with the subject, to construct a meter having a register to run faster or slower, as the specific gravity of the gas might vary. We consider such a device a useless one, as the specific gravity of gas bears but a slight relation to its illuminating power.

Any method, to be of value to the consumer, must be one that can be applied at will and give the mean illuminating power for the periods of time for which bills are made out and collected.

The problem to be solved then is the invention of a means, either as an attachment to the ordinary meter or otherwise, whereby the mean illuminating power, per month or quarter, can be readily obtained by the consumer as well as the companies who supply the gas. This, with the quantity delivered and the mean pressure at which it has been delivered, would form an equitable basis for assessments. The determination of the mean pressure seems to us to be not a difficult thing to accomplish by some simple addition to the meter itself. The determination of the mean illuminating power is by far more difficult to accomplish by the use of mechanism. It does not seem impossible, however, to collect a specimen of gas by means of simple mechanism, that shall be a sample of the mean quality of the gas used during a given space of time.

But how shall this specimen be tested when obtained? There is room here for a good deal of study. It is possible that a fixed relation may be found between the illuminating power of gas and its heating power; if so, the test would be exceedingly simple, but we see reasons that lead us to suppose such a relation would be difficult to establish.

Notwithstanding the difficulties of this problem, we believe its solution is possible and that some inventor will yet realize a fortune, by giving to the public a simple, cheap, and efficient apparatus for determining the illuminating power of gas, and the pressure under which it is delivered as well as the quantity consumed.

EARTH CLOSETS.

The water closet, although a very convenient and almost indispensable appendage to a first-class residence, is open to many objections, arising from carelessness in its management, freezing of pipes, etc., which are too well known to need specification. The earth closet, improved as it has been already, and doubtless will be, is destined, if we mistake not, to prove a formidable rival to the water closet.

The general principle which gives value to the earth closet is the power of earth to deodorize decaying and decomposed organic matters. This is due partly to its absorbent power upon gaseous compounds, and partly to chemical reaction, between the substances of which earth is composed and the offensive matters. The absorbent power of earth upon effluvia has been long known. In rural districts the practice of burying clothes to rid them of smell caused by too intimate contact with that personally disagreeable, but to hop-growers exceedingly useful little animal,—the skunk, is a common practice. It is well known that excrementitious matters, covered with dry earth, are not only completely deodorized, but form the most valuable of all known fertilizers.

The mechanical construction of earth closets, as they are now made, is such, that by a very simple movement, matters deposited therein are instantaneously covered with a layer of dry earth, and, thus deodorized, may be removed with as little offense or trouble as ashes.

The plan is commendable in many points of view. On shipboard its introduction would obviate the most intolerable nuisance. In hospitals it would greatly promote the health and comfort of both patients and their attendants. It is equally applicable to dwelling houses, wherever situated, and under any circumstances whatever, and is as applicable to a commode as to a room set apart for the purpose. It removes all danger of the impregnation of wells with excrementitious matters, an accident now of frequent occurrence, and the cause of frightful epidemics.

Its universal adoption would lessen the demand upon the water supply of cities to a very large extent—an important consideration. It can be made convenient in use, and lastly, but not by any means least, such a system might be made to restore to lands the large amount of valuable fertilizing matters which now flow through the sewers of seaboard towns to contaminate the water for miles around.

The value of this now wasted sewerage is enormous. It may be estimated in millions annually. Engineers have racked their brains to devise some means of utilizing this waste; it seems to us that the earth closet is the true method for its accomplishment. Not that we believe the principle has been yet wrought out to perfection, but that it is capable of being applied so as to cover all the requirements of the case.

Our attention was first called to this subject by the perfect absence of smell, and the superior cleanliness of the earth closets of the Oneida Community, an association which, whatever its errors of belief, is not open to any criticism on the score of cleanliness. These closets are daily cleaned, without inconvenience, by simply drawing away the earth and deodorized matter with the receptacle allotted to them, and replacing it by another. The compost is used on their lands, and is considered an extremely valuable manure.

We are glad to see that public attention is being directed to this matter on both sides of the Atlantic, and we trust the subject will be discussed, and the matter tested until its merits are fully established. A patent is pending at the Patent Office now on a very ingenious earth closet, the invention of an Englishman. As soon as the patent issues we shall probably illustrate the subject in these columns.

EATING CONSIDERED AS NOT A FINE ART.

A man is in one sense a machine. He has his levers, valves, pumps, and pipes. He requires fuel to run him. He is a locomotive engine on wheels, as Dr. Oliver Wendell Holmes has shown. True, his wheels are only segmentary, and each of the two segments has but one spoke; so an entire revolution of either is impossible; but each has a reverse motion, and is lifted and placed back to its proper position, relative to the entire machine, while the opposite one is propelling, so that the necessity of an entire rim and more spokes, connecting it with the hub (hip joint), is obviated. This hub is also a wonderful contrivance; it has many axes of revolution. Instead of revolving on a single axle, it is a ball and socket joint, and may admit of motion on its vertical as well as its horizontal axis, thus enabling the locomotive to get around curves without increased friction, a desideratum long sought for the iron locomotives which man's hands have wrought. The spokes (legs) also have a movable joint in the middle, and another where they join the rim (foot), which latter is as full of joints as it can well be made, having thirty, or thereabouts, exclusive of the lateral articulations of its pieces. A pretty complicated wheel this, but it is nothing to the complication of some other parts of this wondrous machine.

It has arms and hands of still more complex structure with which it performs useful work. It has a force pump and bellows, working constantly, night and day, and a fire box, in which the fuel is placed to keep the whole apparatus in working trim, for if the fire ever goes out and the water gets cold in the boiler, that machine is done with forever; it is worth even less than the old iron of a railroad locomotive. Consequently the prime object of all men, except those unfortunates who desire death, is to supply fuel to keep up steam. The work of the machine then is, or ought to be, worth more than the fuel it consumes. Fortunately, this is the case. For the most part, the work of one of these machines will buy not only fuel for itself, but for a number of smaller ones, and a round house (or square one) in which they all may be stowed away comfortably, beside something to spare for those poor broken machines which can do no useful work but yet claim their share of fuel and cover from the storm.

Its bell and whistle are combined by a curious arrangement and placed in a singular place, *i. e.*, just inside the furnace door. The clapper of the bell is a wonderful piece of mechanism. Look at it closely and you will see that it must have been designed to do a great deal more than to warn folks off the track when the engine is coming. Scattered over its upper surface, most thickly on the posterior portions, are little protuberances, called by the learned papillæ, whose office is to determine the quality of the fuel put into the door, and if this is found to be inferior or injurious to the machine, it, together with the folding stove doors, is so arranged as to reject the fuel. At the same time the clapper most generally rings out a most discordant and angry peal.

Now, if men were machines only, the uses of this apparatus might well end with the selection of proper fuel, and the rejection of the bad or inferior; but we find that, on the summit of the machine, there is a curious apartment—the engineer's domicile, fitted up most elaborately, with two most beautiful windows in front, an apparatus for transmitting sounds upon either side, and another most remarkable arrangement just below the front windows, by which a most subtle and critical examination of fuel as well as other external objects may be made. By means of these beautiful contrivances, the engineer is able to communicate with other engineers, without leaving his apartment, which he never does until he finally abandons his machine as worthless. If we look still more closely, we shall discover little cords running from each of the papillæ to the engineer's room, and also from each of the other pieces of mechanism which we have described. The engineer receives over these cords (each of them in itself a wonder), sensations of pain or pleasure. When bad fuel is put in the fire box, the sensation is generally painful, and *vice versa*. But there may be enjoyment in taking in fuel which has very little economical value, and hence such fuel finds market, and is useful because it keeps the engineer in good temper, and, not unfrequently, prevents disaster from the too free use of fuel which has too high a heating power to be safely used by itself. In fact, the sole end and use of the machine is to give pleasure and happiness to the engineer; for though he may, and should, often use it to give others pleasure, he only does this because he feels high pleasure himself in so doing, or corresponding pain if he leaves the duty unperformed.

To give pleasure to the fine sensibilities of the mind and body is the object of those arts which have been called the fine arts, and there is no doubt that the art of cooking may be legitimately placed in this category. But there is a certain class of philosophers, of whom the celebrated Baron Von Liebig stands at the head, who seem to look upon man, as regards his eating, solely as a machine, out of which the most work is to be got at the least possible cost. Now this appears to us a very unreasonable and narrow view of the matter. If man were merely a machine, it would be sufficient that pain should be felt when noxious substances are presented as food, and thus cause its rejection. The capacity for pleasure would be superfluous. But these reasons tell us the capacity for pain and pleasure are one and the same thing; that a nerve, to be able to transmit a pleasurable sensation, must also be capable of transmitting a painful one; that pain and pleasure are only relative terms; for what is agreeable to one may be disagreeable to another, and "one man's meat is another man's poison." Granted; but what has this to do with the subject? Those who resolutely regard eating as not a fine art, and will compute you the number of ounces of peas for a day's supply to keep a human body warm and provide fuel for useful work; and who, in the application of such rules and computations to the adjustment of a dietetic regimen for the unfortunates who are laid up in hospitals, almshouses, workhouses, and prisons, persist in looking at only the economic bearings of the subject, regardless of the natural and reasonable desires and capacities of human existence, would do well to confine themselves to their own rules for a few years, and see how they like it. We believe that every human being who has not by crime forfeited the common privileges of humanity, and who, by sickness or other unavoidable cause, is incapable of self-care, is entitled not only to mere existence at the hands of his fellowmen, but to the average comforts of life so far as his physical incapacities, which have made him dependent upon others, will admit.

Those who are not thus dependent are right in eating for pleasure as well as for sustenance, always provided they do not run into excess; and so far from calculating whether a certain kind of food is two per cent more nutritious than another, are right in consulting their tastes in the selection of diet; of course, with due reference to the effect the food in question will have upon their general health. In such matters, native instinct is as much to be relied upon as reason, and we are sure it will always be found that he who eats in moderation of the food he likes best, will, all other things being equal, be the healthiest man. It almost gives one the dyspepsia to read the analyses of pork, and beans, and mutton, and sausages, which form the basis of most of the learned dissertations on food now so popular; and for ourselves we shall not be sorry when some other topic shall become a prominent theme to the exclusion of this much hackneyed subject.

THE COLORS OF PLANTS AND FLOWERS.

The coming of spring brings the beautiful green foliage with which all the landscape will soon be covered. If we search in the dry shrubs, or trees, or grass roots, for green coloring matter, we shall not find it. It is not there, nor in the earth nor the air shall we be able to detect it. From whence, then, does it come, and what is it?

If we take some leaves of plants and digest them in alcohol, we shall, after a proper time, find that their green coloring matter is dissolved, and our alcohol has become a beautiful green solution. By careful evaporation we drive off the alcohol, and have left a splendid natural pigment, which chemists have called chlorophyll, from the Greek words *chloros*, green, and *phyllon*, a leaf.

It contains four elements, carbon, hydrogen, oxygen, and nitrogen, the first of which is black except when crystallized or combined with other substances. The other substances are colorless gases. These combined produce the tints of green which make the earth so beautiful in its seasons of verdure.

Chlorophyll is, according to Miller, of a resinous nature. By some authors it is supposed to be composed of two compounds, one of which is blue and the other yellow, which colors, blended, produce green. Be this as it may, the ultimate elements are those above mentioned. It is not known whether this matter is generated during the cold of northern winters, in the evergreens which retain their leaves during the months of frost, or whether the color produced during the warmer season is merely retained unaltered within the leaves. Whether this be the case or not, it is certain that without sunlight it never is formed. It is the sunbeam that mixes the color and, with exquisite pencil, adorns the delicate 'eaflet as it issues from the opening bud. Place a plant in the dark and it sports no beautiful colors. It dons white, the hue of death. Take it now and place in the light—not in the intense and concentrated light and heat of the sun—it is too weak to endure that—but in a shady place where the light can touch it gently and lovingly, and see how delicately the tints will be laid on, deepening gradually until it is clothed with emeralds. A sunbeam is a painter which art cannot imitate or even approach.

The coloring matters of flowers have been made the subject of elaborate study by Fremy and Cloez. They consider these substances to be instrumental in producing all the tints to be seen on the petals and internal organs of blossoms. These substances are respectively called Cyanin, Xanthin, and Xanthein. Cyanin is a vegetable blue, or rose color, which reddens by the action of acids. Blue flowers are found to possess a neutral juice, while the juices of red flowers have an acid reaction, corresponding to the action upon blue litmus paper of acids and alkalies. Xanthin is a yellow substance, insoluble in water, and existing in great abundance in the leaves of the sunflower. Xanthein is a yellow substance, soluble in water, and obtainable from the leaves of the yellow dahlia. Acids turn xanthein brown.

Miller says of these substances, however, that "not one of them has ever been isolated in a pure condition, and there is considerable doubt whether the colors of the flowers of different plants be due uniformly to the same materials. The yellow coloring matters, however, are clearly of a nature different from that of the blues and reds. Many red flowers become blue and green as they wither, but they never become yellow. Blue flowers are also sometimes observed to fade into red before the color disappears, but they never become yellow; and, on the other hand, a yellow flower as it withers never becomes blue."

The yellow color acquired by leaves before their fall in autumn, is ascribed by Fremy to the gradual destruction of a blue constitutent of chlorophyll, which he calls Phyllocyanin, the other constituent being a yellow substance which he calls Phylloxanthin. These substances may be separated by the following method, which constitutes a very pretty experiment:

Boil the alcoholic solution of chlorophyll, obtained as above, with an alcoholic solution of potash. Neutralize this solution hydro-chloric acid, and the phylloxanthin will be precipitated; the phyllocyanin remaining in solution, to which it gives a beautiful blue color.

VELOCIPEDE NOTES.

The *Ironmonger*, all along a firm believer in, and supporter of the claims of the velocipede to public esteem, thus sums up its merits: "The velocipede, as embodying the combination of physical with mechanical power, for the purpose of locomotion, has had its claims to adoption fully vindicated; while as an amusement, it is in many respects superior to horse riding, cricket, skating, or even rowing. A properly-designed velocipede, allowing, as it does, of the full development of the chest and lungs, constitutes one of the best aids to the much-desired improvement of the human body. Among other hygienic advantages, respiration is facilitated, and the muscles of the back and shoulders are relieved from the injurious strain often imposed by habits of stooping. Lastly, velocipathy—thanks to our *alma mater* for the term—is the most excellent tonic and appetitizer of the modern Pharmacopœia. Then as to the danger of running over people, the velocipede is more under the control of the rider than any horse-driven vehicle. But it is the country, not the city or town, that is destined to be the scene of its greatest exploits. Very few have had the opportunity of giving them a trial on our country roads, though there is no longer any doubt of their utility *in rure* In France, velocipedes are not only the amusements of the Paris *gamins* of the Boulevards, but are found to constitute a convenient means of seeing a country without walking. Four velocipedes drove up the other day to the Hotel de France, at Mans, their drivers having started together on a tour from Trouville, whence they velocipeded up to Paris. From the capital they started for Bordeaux, Ferte, Bernard, and Mans, accomplishing, on an average, 30 miles per day. This fact testifies to the safety as well as the speed with which velocipedes may be driven, for it is only reasonable to suppose that somewhat rough ground must have been encountered on the tour."

The same periodical states that there are as yet no water velocipedes in the English market, but that various addenda, such as protectors from rain and dust, etc., etc., are in demand.

A French theater announces the "*pas diabolique*," whatever that may signify, to be performed with the prancing and curvetting *veloce* at full speed. The passion for velocipede performances is so great, that the Paris Censor has ordered that not more than twelve velocipedes should appear on the stage at any one time.

European exchanges show no falling off in the popularity of the bicycle in France, while in England the *furore* is on the increase.

In this country the popularity of the velocipede gains daily. What is wanted in each of our large cities is a velocipede race course. Upon this subject the New York *Sun*, which daily illuminates its readers upon velocipede matters as well as other subjects of popular interest, says: "Outside of Paris they have a regular velocipede course of a mile circle, with a roadway so smooth and hard that one could play billiards on it. The races on this course are crowded with fashionable assemblages, the ladies especially thronging the grand stand reserved for their use. On this course the extraordinary time of a mile in two minutes and fourteen seconds has been accomplished on a 45-in. wheel, French model. Now, we have as yet nothing like this course in this country, and one is wanted; and, if properly conducted, it would pay a handsome return on the investment. As regards locality, the Capitoline grounds, Brooklyn, are just suited for the purpose, but as yet no track has been prepared, the expense being rather great. The little experience already had in races—one opponent against another—in this vicinity, proves conclusively that such contests would be extremely attractive, and, what is more, would be well patronised by the reputable classes of the community. As for velocipede races on horse-track courses, the affair at the Union Course showed that anything of that kind would lower the standard of the sport, and, beside, be unprofitable. A horse race is exciting, but how much more so is a contest in fast riding between skillful velocipedists. Races of this kind have been adopted as one of the features of the exercises of the New York Athletic Club, and with the trials of skill which will take place between rival velocipede clubs, a series of exciting and deeply interesting bicyle races will be inaugurated for each year, well calculated to attract large and fashionable assemblages of spectators. Let us have no more races on trotting courses. Velocipeding now is in respectable hands, and has a reputable status as a gentlemanly sport and exercise. Let it be kept so, and do not allow it to be contaminated with the evil associations, such as have nearly killed the national game of base ball within the past three years.

"Owing to the lamentable ignorance of the common laws of physiology which prevails among the mass of the community, empirics find no difficulty in foisting the most absurd notions on the people as medical facts; but we have been surprised to see in the editorial columns of papers supposed to be edited by educated men, statements in regard to alleged injuries riders of bicyles are subject to, which are calculated to make respectable medical men laugh. The *Sunday Mercury* had an editorial lately, which actually attributed Bright's disease to the bicycle. The *World*, too, the other day, in an editorial snarl at velocipedists, attributed still more fatal results to the poor velocipedes. Now, in the first place, velocipede riding can have no objection urged against it as a cause of any class of injuries to which horseback riding is not equally amenable. But the most absurd charge yet made is that of its causing ruptures and hernia. The majority of the people who talk such stuff have about as much of an idea of what constitutes a rupture as they have of the theory of electrical phenomena. Except caused by a severe fall and consequent strain, a rupture from velocipede riding is an impossibility; and in regard to a fall, a man is as liable to it from that in a carriage, or on horseback, or in a ball field, as in falling from a bicycle. The whole subject of these alleged injuries, however, is the veriest bosh, and it is a disgrace to the editors of the journals who publish such paragraphs. Respectable physicians advocate it as a healthy healthy exercise, and practice it too."

Mr. Clow, proprietor of the Smoky City Rink, at Pittsburgh, has had a bridge made for his rink, which, we think, is the greatest obstruction yet surmounted by a velocipede; it is five feet high at center, the inclined sides being but twelve feet long by four wide, giving a rise of one foot in two; this was a dangerous looking affair, having no railing at the sides, and being placed near the middle of the floor, required a steady hand, head, and feet; it was, however, successfully crossed several times at the inauguration of the rink; the younger Pickering letting go the handles just before reaching the top, guided his machine over, and down and around the room entirely by his feet—two only of the scholars cared to attempt this feat, the first getting sufficient speed on his machine to carry it and him about half way up the incline, from which point he very graciously *backed down*, the floor receiving him and his veloce considerably *mixed*. Another member, in whose make-up the word "fail" seems to have had no part, then tried his try, and passing the upper point came down the incline safely until he reached the floor, when he and his veloce suddenly came to the ground; a second and third attempt proved more successful, and he now wants the bridge higher and longer.

A journey on bicycles from Liverpool to London, by way of Oxford and Henley, has just been accomplished by two of the Liverpool Velocipede Club. On the evening of March the 25th, A. S. Pearson and J. M. Caw, the honorary secretary of the club, set off from the shores of the Mersey for a "preliminary canter" to Chester, from which city they started in earnest on the following morning. After a ride of fifty-nine miles they arrived at Newbridge, near Wolverhampton, where they stayed the night. On Friday the velocipedians, having traversed the Black Country, went on to Woodstock, a distance of sixty-nine miles, where they slept. On Saturday night the tourists arrived in London, feeling none the worse for their long ride. Their bicycles caused no little astonishment on the way, and the remarks passed by the natives were most amusing. At some of the villages the boys clustered round the machines, and, when they could, caught hold of them, and ran behind until they were tired out. Many inquiries were made as to the name of "them queer horses," some calling them "whirligigs," "menageries," and "valaparaisos." Between Wolverhampton and Birmingham attempts were made to upset the riders by throwing stones. The tourists carried their luggage in carpet bags, which can be fastened on by strapping them either in front or on the portmanteau plate behind.

The New Explosive.

The recent disastrous explosion in Paris in a manufactory for the preparation of picrate of potassium, coupled with the fact that there are many other such establishments in which the accident may any day occur, gives a peculiar interest to details simply chemical in their nature. The picrate of potassium is the potassium salt of an acid to which the names trinitrophenol, trinitrocarbolic acid, picric acid, carbazotic acid, picranisic acid, chrysolepic acid, &c., have been given. The acid, a frequent product of the action of nitric acid on organic substances, was discovered by Hausmann in 1788; has been the subject of investigation by Liebig, Dumas, and Laurent; and was first accurately described by the last-named chemist, who proved it to be carbolic acid in which three atoms of hydrogen have been replaced by three atoms of the group No 2. This constitution at once explains the explosive character of the acid and of its salts. It will be seen that the oxygen, of which there is a large quantity, is nearly all combined with nitrogen. Now, compounds of oxygen and nitrogen are very easily decomposed, especially in the presence of substances having a powerful attraction for oxygen, such as carbon and nitrogen. Gunpowder, for example, is a mixture of a substance containing oxygen united to nitrogen (saltpeter), and a substance having a strong attraction for oxygen (charcoal); while in gun-cotton, nitro-glycerin, picric acid, and the picrates we have the two united in one compound. Stored up in all these substances is a potential energy which betrays its presence by explosion when the oxygen leaves the nitrogen to unite with the carbon and hydrogen. The picrates differ a good deal as to the rapidity and violence of this decompositon; the picrates of mercury, silver and copper on the one hand burning quickly, like loose gunpowder, and on the other, the picrates of calcium, lead, and especially potassium, exploding with a loud detonation when heated on a flat plate, or when sharply struck by a hard body. The first to make practical application of this property of picrate of potassium was Mr. Whitworth, who used the salt to fill shells to be directed against the armor plating of ships. While picric acid may be prepared by the action of nitric acid on many organic substances, such as indigo, aloes, silk, carbolic acid, or salicin, the most convenient and economical material is the so-called "yellow gum," or resin of the *Xanthorrhea hastilis*, which yields, according to Dr. Stenhouse, about fifty per cent of the crystallized acid. The substance is chiefly used as a yellow dye for silk and wool, and as a means of distinguishing animal from vegetable fibers, the former being colored yellow by it, the latter remaining unchanged. It is employed in the laboratory to distinguish salts of potassium from those of sodium: the picrate of potassium being very sparingly soluble in water, while the picrate of sodium dissolves readily.

Changing Clothing.

Many persons lose life every year by an injudicious change of clothing, and the principles involved need repetition almost every year. If clothing is to be diminished, it should be done in the morning, when first dressing. Additional clothing may be put on at any time.

In Northern States the under garments should not be changed for those less heavy sooner than the middle of May; for even in June a fire is very comfortable sometimes in a New York parlor.

Woolen flannel ought to be worn next the person, by all, during the whole year, but a thinner material may be worn after the first of June.

A blazing fire should be kept in every family room until ten in the morning, and rekindled again an hour before sundown, up to the first week in June and from the first day of October.

Particular and tidy housekeepers, by arranging their fireplaces for the summer too early, oftentimes put the whole family to a serious discomfort, and endanger health by exposing them to sit in chilliness for several hours every morning, waiting for the weather to moderate, rather than have the fireplace or grate all blackened up; that is, rather than be put to the trouble of another fixing up for the summer, they expose the children to croup and the old folks to inflammation of the lungs. The old and the young delight in warmth; it is to them the greatest luxury. Half the diseases of humanity would be swept from existence if the human body were kept comfortably warm all the time. The discomfort of cold feet, or of a chilly room, many have experienced to their sorrow; they make the mind peevish and fretful while they expose the body to colds and inflammations which often destroy it in less than a week.—*Hall's Journal of Health.*

Editorial Summary.

THE outcry made some months ago against the abuse of the franking privilege on the part of Members of Congress seemed to put a check upon it for a while, but we have now before us a private business circular of a Washington firm, styled "Swetland & Co.," franked by the written signature of Hon. John T. Deweese, Member of Congress from North Carolina. We call the attention of the Hon. Mr. Deweese and of Postmaster-General Cresswell to this system of *sweating* the postal revenue. It's not fair, it's not honest.

IT is announced that the city of Boston was gently rocked in the lap of a tender earthquake on the afternoon of April 23d. The localities affected were Brookline, Hingham, Stoughton, Canton, Dedham, and South Dedham. It occurred at nearly three o'clock with a heavy report and a vibratory sensation, which did not last more than three seconds. The crockery-ware shook in the closets, and the glass in the windows. The weight and duration of the shock was greatest at Dedham.

A MUSEUM of Natural History is to be established in the Central Park, in this city, $50,000 having already been subscribed for that purpose. The Commissioners of the Park have offered the use of the large hall of the Arsenal Building as a place where the collections may be deposited until a suitable structure can be erected. We understand it is proposed to erect a museum building on Ninth avenue, fronting the block between Seventy-eighth and Seventy-ninth streets.

INVENTORS who have English patents, or would like to introduce their inventions in Great Britain, will find it for their interest to consult a member of an old established firm, who is temporarily stopping in this city. See advertisement on another page.

SOME of our cotemporaries are designating the new Commissioner of Patents as "Judge" Fisher and "General" Fisher, neither of which titles are applicable. Mr. Fisher is a lawyer by profession, and held the position of Colonel of the 138th Ohio Volunteers.

THE manufacture of beet-root sugar was begun in a small way at Oshkosh, Wis., some time ago, and proved so remunerative that an immediate enlargement of the works is contemplated.

COMMISSIONER FISHER has removed Examiners Peters and Barnett. It is likely that other changes will be made.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

STEEL RAILS.—The question of the manufacture of steel rails continues to be a subject of intense interest in the iron districts of England. The *Birmingham Daily Gazette* gives an account of the Siemens-Martin process, which has recently been brought into practice on a manufacturing scale at the North Yorkshire Steel and Iron Works, near Stockton-on-Tees, by Mr. Samuelson. The works were recently put into operation, and on the following day, the first rail was rolled for the Darlington section of the North Eastern Railway Company, with, it is said, perfect success. "The rail placed on bearings 3 feet 6 inches apart, was subjected to the impact of a ball weighing 22 cwt., falling from a hight of 30 feet, without showing the slightest flaw, and each subsequent day's product has borne the same extraordinary test." Mr. Siemens himself is erecting similar works in South Wales.

UTILIZATION OF BLAST FURNACE SLAG.—The following method is now adopted in several iron works in Belgium: The slag is allowed to run direct from the furnace into pits about eight or nine feet in diameter at the top, with sides sloping inwards towards the center, where they are about three feet deep. The mass is left for eight or nine days to cool, when a hard compact, crystalline stone is obtained, which is quarried and used for building purposes, but chiefly for paving stones. They appear to wear exceedingly well, being quite equal to the grits and sandstones already so much used.

The Lawrence (Mass.) *American*, gives the number of operatives employed in the manufacturing establishments of that city. The total number is 10,542; 4 558 males and 5,984 females. The Pacific Mills employ 3,687 hands; the Washington, 2,812; Atlantic 1,150; Everett, 883; Pemberton, 836; Arlington, 199; Duck Mills, 180; Russell Paper Company, 138; Lawrence Woolen Company, 116; Gilmore's Straw Works, 134; Wright Manufacturing Company, 99; Lawrence Worsted Company, 79. The total number of hands employed in the manufacturing establishments of Lowell is 13,927; 4,914 males and 9,013 females.

WISCONSIN WOOLEN MANUFACTURERS' ASSOCIATION.—The Wisconsin woolen manufacturers held their annual meeting at Milwaukee on the 18th of April. The display of samples from some of these mills was very creditable; the Racine shawls and Appleton doeskins, flannels, and cassimeres being especially fine. A committee was appointed to consider the expediency of holding an annual trade sale. The next meeting will be held in Milwaukee, in April, 1870.

A blast furnace for the manufacture of charcoal pig iron is to be established at Frankfort, on the eastern shore of Lake Michigan, by a company recently organized in Detroit, with a capital of $100,000.

A furniture factory in Hanover street, Boston, employs 500 hands, runs a 100 horse-power engine, and keeps constantly on hand 1,500,000 feet of dry black walnut lumber.

In a few weeks the Rock Island and Pacific railroad will be completed to Council Bluffs, and thus Chicago will have two entirely independent lines to Omaha.

In the lumber yard of the Pacific railroad, at Omaha, are stored four and one-half million feet of lumber, and seven hundred and sixty-eight workmen are employed.

A rolling mill to employ one hundred and fifty hands is about starting at Joliet, Ill.

Answers to Correspondents.

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

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

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

S. J. K., of Vt.—No perceptible effect is produced upon a weight suspended from a spring balance during the conjunction of the sun and moon, by their united attraction. It is only upon very large bodies that this cause could produce a perceptible effect, and the effects perceptible in large bodies bodies of water are very slight when compared to their entire bulk. When you consider that the highest mountains are far less in proportion to the entire bulk of the earth than the wrinkles on the rind of an orange are to its bulk, you will see that the highest tidal wave is a very small thing compared to the mass of the earth. The statement that the sun is four millions of miles nearer than was originally computed from the transit of Venus, is based upon more recent calculations made from other data and is now universally admitted by astronomers. Nitro glycerin is made by dropping glycerin into equal parts of strong nitric and sulphuric acids; it is a dangerous plaything. You will find some hypotheses in works on physics, upon the cause of the refraction of light, but nothing positive has been demonstrated as to its ultimate cause.

H. A., of Col.—The cubic foot of water weighs 62½ lbs. and converted into steam of atmospheric pressure would contain for each lb. 537 centigrade units of heat, and for the 62½ lbs., 537x62½ or 33,562 units of heat. A nominal horse power, per hour of 60 minutes, is obtained by the combustion of 2½ lbs. of coal and evaporation of 25 lbs. of water, containing 25x537 or 13,425 units of heat. A nominal horse power per hour is equal to 33,000x60 minutes or 1,980,000 foot lbs. per hour. Dividing 1,980,000 foot lbs. by 13,425 would give us 1,474 foot lbs. as the mechanical equivalent of 1 unit of heat of atmospheric pressure—a portion of heat being lost. This equivalent is however too low by from 20 to 30 per cent.

T. J., of Ill.—"Can two pieces of flat iron be so fitted with a file, that by placing one upon the other—no oil or other substance between—the atmospheric pressure will keep them together." We see no reason why the two pieces cannot be fitted by the file; it is often done by scraping surfaces. We doubt, however, if the surfaces are held in contact by atmospheric pressure alone. Cohesion of particles is probably the source of the force or attraction that holds the two surfaces together.

A. T. C., of N. Y.—Castor oil is unfit for lubricating either gun locks or any other mechanism. It is viscid and "gummy." Better is pure sperm, porpoise, olive, or poppy oil. Don't gum up your gun with it.

G. F. S., of Mass.—If you cannot reach the defect in your steam cylinder to plug it, or melt in a composition, stop the hole with a mixture of two parts sal ammoniac with eight parts fine cast iron filings. No sulphur to be used.

A. T. C., of———To remedy the fault in your blackboard give it a coat of lampblack and japan varnish. The lampblack should be deprived of oil if necessary by heating in the usual way.

H. D. D., of Texas.—Water might without doubt be brought over the neck of land of which you speak in syphons. The distance however, is so great in proportion to the fall, that with your low head, you would get a sluggish flow on account of friction, we do not feel justified in recommending the attempt as a means of getting power.

A. W., of Mo.—The separation of silver from lead is profitably done in many places. The information you seek can be found in Phillip's "Mining and Metallurgy of Gold and Silver," sold by D. Van Nostrand of New York city.

W. S., of Wis.—We have carefully examined your article upon velocity, and it is evident to us that you do not understand the subject. We prefer not to publish crude notions upon abstract scientific subjects.

F. S., of Mich.—The cost of beet root sugar machinery given in our paper is based upon the charges in gold for such machinery in France. The other information that you seek on the subject will be given in the remaining article of the series.

R. M. C., of Iowa.—We cannot undertake to verify the correctness of your analysis of composite numbers. Such investigations require more of our valuable time than we can afford to bestow upon subjects of that character.

H. H., of Berlin.—You mistake our position entirely. We are opposed to all swindling rings, but we do not propose to revive and denounce old swindles that have gone out of sight. Our paper would not be large enough to keep pace with active operations of that kind going on.

J. B. U., of Md.—We did not preserve the letter of the correspondent to which you refer, therefore cannot send his address.

E. R., of N. Y.—Your idea of crossing Broadway by the use of wings or the flying trapeze, is novel, to say the least, but it scarcely merits notice as a practical scheme.

E. P., of N. Y.—We recommend you to write to H. C. Baird, of Philadelphia, for a work on the art of perfumery.

R. H., of Ill.—The law enacted by the legislature of your State, in reference to the sale of patent rights, is intended to put a check upon frauds. It cannot interfere with legitimate sales of patents.

C. F., of Ohio.—Good white lead putty is as good as anything for an aquarium. The water ought to be changed several times however before putting in your fish.

E. E., Ind.—A good varnish to protect tin plate is lacquer, similar to that used for brass, and applied in the same way.

NEW PUBLICATIONS.

A Practical Treatise on Metallurgy. Adapted from the last German Edition of Prof. Kerl's "Metallurgy." By William Crookes, F. R. S., and Ernst Rohrig, Ph. D., M. E. In three volumes. Vol. II. Copper and Iron. Illustrated with 273 Wood Engravings. New York: John Wiley & Son, No. 2 Clinton Hall, Astor Place.

It is impossible, in the brief space allotted for new publications in our paper, to give even the most cursory review of the volume before us. The well-known excellent reputation of the first volume of the series is fully sustained in this volume, which is devoted to the metallurgy of copper and iron. One of the many praiseworthy features of this work, is the attention paid to minute details. It is what it claims to be, "practical," and thus is suited to the exigencies of the unlearned. At the same time the scientific metallurgist will find all that is needful. The original treatise of Prof. Kerl has long occupied the front rank among works upon this subject. The mechanical part of the subject is sufficiently treated, although it is not made a prominent feature. We regard this as one of the most valuable additions to metallurgic literature that has issued from the scientific press. From the miner and smelter, to whom it is of the first importance, through all departments of iron and copper working, it cannot fail to be of great service.

We are indebted to the publishers, Messrs. Lee & Shepard, Boston, for two interesting and instructive pamphlets. "The Controversy Between True and Pretended Christianity" is a tersely-written essay, originally read before a Massachusetts Methodist convention, by Rev. L. T. Townsend, Professor of Historical Theology in the Boston Theological Seminary. Price, bound, 50 cents; in paper, 25 cents. "Woman as God Made Her; the True Woman." by Rev. J. D. Fulton, the popular, wide-awake pastor of Tremont Temple Church, Boston. Its aim is to set forth the divine ideal or women in her various relations, and under such heads as Woman as God made Her, Woman a Helpmeet, The Glory of Motherhood, Woman's Work and Woman's Mission, he presents his views in the pungent, epigrammatic manner characteristic of him either as pastor or author. Price, $1 bound; paper, 50 cents.

Recent American and Foreign Patents.

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

Manufacture of Pipe Elbows.—Edwin Norton, Toledo, Ohio.—This invention relates to improvements in the manufacture of pipe elbows, whereby it is designed to simplify and cheapen the cost of the same, and it consists in the production of the blanks, of the proper form, for both parts of elbow, from one sheet of metal, by dies so arranged as to cut the same at one blow, and without waste of metal.

Machinery for Washing Wool.—John McNaught and Wm. McNaught, Jr., Rochdale, England.—This improved machinery consists of a series of two or more rakes, or other equivalents, for traversing the wool, or other fibers, along the cistern to an inclined plane, up which they are moved by an improved cradle, or other equivalent, and delivered to a series of rollers which convey them to the squeezers.

Quilting Frame.—Josiah Odell, Petroleum Center, Pa.—This invention relates to improvements in quilting frames, designed to make them more conveniently and useful, as such, than any now in use, and to adapt them also for use as a clothes frames. It consists in certain improvements in means for clamping the bars of the frame together, and arrangement of the said bars calculated to adapt the frame to the said double use.

Machine for Bending Felloes.—De Lyon & Werner, Canton, Miss.—This invention relates to improvements in machinery for bending felloes, and consists of a curved former, mounted on an axis and working over a movable carriage, whereon the stick to be bent is placed between the face of the former and a metallic strap, which is bent up with the stick and secured to the former, to hold the bent stick until it becomes set.

Governor Valve.—W. W. Gilbert, New York city.—This invention relates to improvements in governor valves for steam or other engines, whereby it is designed to provide an arrangement whereby the valve may be opened or closed, either by a movement in the direction of its length or a rotary movement; also, to provide an arrangement whereby the valve will be automatically closed when the governor ceases working from any cause; and also, an arrangement to facilitate the increasing or diminishing the volume of steam through the medium of the said governor valve without effecting the operation of the valve by the governor.

Medical Compound.—Henry Adolph, Clinton, Kas.—This invention relates to a new and useful composition to be used as a liniment for external diseases in sheep, horses, and cattle, also valuable as a remedy for leprosy, and other diseases to which the human system is subject.

Heater and Ventilator for Railroad Cars.—Asa Weeks, Minneapolis, Minn.—This invention is an improvement upon the one patented by me January 5th, 1869, No. 85,712. It differs from it in the construction of the large heater, and the means for adjusting its draft, and for cleaning it out when foul.

Railroad Chair and Tie.—Thomas F. Fouts, Albia, Iowa.—This invention relates to new and improved method of constructing railroads, and consists in the peculiar form of the chairs and ties, and the manner of securing the rail thereto, and of preventing the spreading of the rails and the settling of the track.

Machine for Picking Curled Hair Rope.—H. R. Hildreth, Lynn, Mass.—This invention relates to a machine for untwisting and picking hair rope, thereby rendering it suitable for use in upholstering or other purposes.

Subsoil Plow.—James B. Pullman, Los Angeles, Cal.—This invention consists in the combination of a share of peculiar construction with a coulter having a concave cutting edge, both being affixed to a plow stock of the usual construction.

Toy Gun.—W. I. Blackman, Columbus, Miss.—This invention relates to that class of articles which are designed for children's use and amusement, and consists of a barrel, and stock, and rubber springs, combined and arranged so as to form a gun, the projectile being impelled by the recoil of the springs.

Straw Cutter.—Ellis Douty, Collomsville, Pa.—This invention relates to those straw-cutting machines, in which a straight knife or cutter is employed in a reciprocating frame sliding vertically on the front uprights, and operating to bring the edge of the knife downward across the end of the box.

Mash Tub.—Marshall J. Allen, New York city.—The object of this invention is to provide an improved means for heating and cooling the contents of mash tubs, such as are used in distilleries and breweries.

Mail-bag Fastening.—J. A. Truitt, Oakland, Pa.—This invention consists of a sliding chain arranged in one part of the bag, capable of receiving the staples of the fly through its links, and provided with a staple in each link, which will, when the said chain is drawn transversely of the bag, engage each of the said staples of the fly and thereby fasten the two parts together.

Registering Counter for Billiards.—W. A. Hough, St. Johnsville, N. Y.—This invention relates to improvements in connecting and registering apparatus for billiards, and has for its object to provide a simple and reliable apparatus that will keep the count for each game, and register the number played by each party, and the whole number played during a day or other stated periods.

Piston Packing.—Wm. Ord, Brooklyn, Ohio.—This invention relates to improvements in piston packing, designed to provide an arrangement of simple, and cheap construction, capable of more perfectly fitting the cylinder, simple of adjustment, and less liable to spring away from the cylinder after being set out than any arrangement now in use.

Farm Gate.—J. T. Moxley, Owasso, Mich.—This invention is to provide a farm gate which is simple and effective.

Clevis for Plows.—G. W. Holton, Berlin, Ky.—This invention consists in making the end bar of the clevis considerably longer than the present construction, preferably arranging the elongation below the part engaging the plow beam, and providing at the said end as many hitching rings as it will support by passing through transverse holes and preserve a sufficient amount of strength. The projecting end is strengthened by suitably bracing it.

Apparatus for Displaying Goods.—John D. Chambers, West Lebanon, Ind.—This invention relates to improvements in apparatus for displaying goods in mercantile establishments, generally woven fabrics; and it consists in the yard arms on which the goods are to be spread, adjustably supported on a stationary vertical shaft, so arranged that they can be raised up or let down, and turned to any point around the axis of said shaft desired, provided with a wire or cord above them for supporting covering for protecting goods.

Steam Pump.—W. W. Gilbert, New York city.—This invention relates to improvements in steam pumps, having for its object to provide an improved arrangement of the steam valve mechanism, designed to insure a better and more reliable action of the same; also, an arrangement of the pump valves to facilitate the removal of the same for inspection or repairs, as may be required.

Grain Drills.—H. B. Dean and S. A. Baker, Ludlowville, N. Y.—This invention has for its object to improve the construction of grain drills so as to make them more durable, convenient, and satisfactory in use.

Windlass.—L. M. Knowles, Owatonna, Minn.—This invention has for its object to improve the construction of windlasses for raising water and for raising and lowering light weights, so as to make them more convenient and reliable in use.

Derrick.—Newton Matlick, Williamstown, Mo.—This invention has for its object to furnish an improved derrick, which shall be simple in construction, easily moved from place to place, and conveniently operated, raising the hay or other weight, and, at the same time and by the same operation, swinging it into the position it is to be placed.

Railroad Bar.—James Myers, Jr., Williamsburgh, N. Y.—The nature of this invention consists in constructing a rail or railway bar, such as is used for the track upon which railway locomotives and cars are ordinarily moved, in such a manner that the rail or parts of the same shall consist of an interior core of ordinary wrought or malleable iron, and an outer envelope of steel, formed from a homogeneous bar of wrought or malleable iron by the conversion of the outer portions of such bar into steel by chemical processes.

Hay Loader.—Winfield Denton, Iowa City, Iowa.—This invention has for its object to furnish an improved device, by means of which the hay may be easily and conveniently loaded upon a wagon or cart without the necessity of hand pitching.

Seed Planter.—W. W. Haupt, Mountain City, Texas.—This invention has for its object to furnish a simple and convenient seed planter, which shall be so constructed and arranged that it may be easily and conveniently adjusted to plant various kinds of seeds.

Washing Machine.—David Graves, Spring Valley, N. Y.—This invention has for its object to furnish an improved washing machine, which shall be so constructed and arranged as to do its work quickly and thoroughly, under the combined operation of pressure, rubbing, and rinsing.

Elevator Attachment for Fan Mills.—Newell Hinman, Sparta Center, Mich.—This invention has for its object to furnish an improved elevator attachment for fan mills, by means of which the cleaned grain, as it runs from the mill, is raised up, and discharged into the hopper, from which it may be allowed to flow into bags or other receptacles.

Mowing Machine.—Wm. H. Knight, East Machias, Me.—This invention relates to a new mowing machine, in which the motion from the driving wheel is transmitted to the cutter bar or bars entirely, by means of levers, without the use of any cog wheels whatever, so that thereby a large amount of friction is saved and much power gained. The invention consists in the arrangement of the levers for transmitting the motion in the manner of connecting them for use on double cutters, and in the application of means for regulating the hight of the cutting apparatus and for throwing the same out of gear.

Metallic Beams and Girders for Bridges.—Joseph Gill, Cincinnati, Ohio.—This invention consists in the adoption of one, two, or more series of polygonal, or circular cells (measuring those of an hexagonal shape), formed out of flat bars of wrought iron, steel, or other metal, with the ends when turned into shape, either welded together, or left meeting in a butt open joint; and, having each of their sides perforated by punching, or drilling with one, two, or more holes for the reception of rivets, or screw bolts, to fasten them together; said cells, when so united, forming a rigid beam of metal, and which beams may be so built up to any hight, as to obtain any desired strength.

Syringe.—James J. Essex, Newport, R. I.—The object of this invention is to so arrange the discharge pipe of an elastic bulb syringe, that the admission to, and the consequent discharge of air from said pipe, cannot take place as long as liquid matter is forced through the same.

Deck Stovepipe for Vessels.—John Hall, Boston, Mass.—This invention relates to a new device for making the stovepipes on the decks of vessels flexible, to prevent their being injured when struck by swinging booms, yards, or other devices. When they are rigidly attached, as heretofore, it often, or generally happens, that, especially on cabins, galleys, and forcastle, they are bent, broken, or otherwise injured by booms or yards, or that the decks from which they project become leaky by the strain brought to bear on them.

Apparatus for Propelling Vehicles.—Peter Robert, New York city.—This invention relates to new machinery for operating the propelling apparatus of canal boats and other kinds of machinery, and also to a new kind of propelling apparatus for the same. The invention consists chiefly of a series of floats, or propelling feet, which are vertically lifted out of, and vertically carried back to the position which they operate. The invention also consists in the use of certain machinery for propelling the carriages from which the aforesaid floats or feet are suspended, and for elevating and lowering the said floats or feet at the end and commencement of each stroke.

Cooking Stove.—Wm. C. Durant, West Troy, N. Y.—This invention relates to a new cooking stove, in which a new device for heating the air that is brought to the fire box is provided by the peculiar construction of a hollow door, and in which a circulation of air is provided through the oven into the fire place, so that the oven may receive a constant supply of fresh hot air and transmit a constant supply of hot air to the fire place; thereby the oven is kept fresh and clean, and does not emit disagreeable vapors when opened.

Soldering Apparatus.—Charles Pratt, New York city, and Conrad Seimel, Greenpoint, N. Y.—This invention relates to a new attachment to soldering apparatus, of that kind in which the cans to be soldered are supported on a base plate, shield, or platform, the same being either rigidly secured to, or adjusted on a frame, or floating on the solder. The object of the invention is to prevent the can from adhering to the said supporting platform or shield, and to facilitate its removal when soldered. In the present apparatus, air is caught and confined between the lower end of the can and the supporting platform, or shield, and as the joint between the latter and the can is, by the liquid solder, generally made air tight, the removal of the can is made extremely difficult and connected with much loss of time.

Velocipede.—Wm. H. Smith, Newport, R. I.—This invention relates to a new velocipede, which is provided with a steering apparatus of novel construction, and also with a new brake attachment, its object being to simplify the construction of the parts and to obtain higher and steadier motion. The invention consists chiefly in connecting the rear steering wheel or wheels by a novel system of leverage with a steering handle in front of the frame, and also in providing to the front of the frame an up-and-down sliding brake and starter

APPLICATIONS FOR THE EXTENSION OF PATENTS.

Candle-mold Apparatus.—Willis Humiston, of Troy, N. Y., has petitioned for the extension of the above patent. Day of hearing, July 5, 1869.

Bottle Stopple.—Thomas Allender, of Westhampton, Mass., executor of the estate of John Allender, deceased, has petitioned for the extension of the above patent. Day of hearing, July 5, 1869.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING APRIL 27, 1869.

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89,267.—Device for Cutting Bolts.—Geo. Adair and J. F. Pool, Monroe, Wis.

89,268.—Rotary Pump.—M. L. Andrew (assignor to himself and Geo. Burrows), Cincinnati, Ohio.

89,269.—Rotary Pump.—M. L. Andrew (assignor to himself and Geo. Burrows), Cincinnati, Ohio.

89,270.—Holder for Candles and Ornaments on Christmas Trees.—Gustav Anton, Philadelphia, Pa.

89,271.—Vapor Burner.—S. D. Baldwin (assignor to himself and Daniel Leonard), Chicago, Ill.

89,272.—Sash Lock.—R. R. Ball, West Meriden, Conn. Antedated April 24, 1869.

89,273.—Sash Lock.—R. R. Ball, West Meriden, Conn. Antedated April 24, 1869.

89,274.—Surfacing Fabrics with Bronze or Metallic Powders.—J. B. Batchelder, Boston, Mass.

89,275.—Sewing Machine for Sewing Leather.—E. E. Bean, Boston, assignor to David Whittemore, North Bridgewater, Mass.

89,276.—Fastening for Carriage Seats.—William Beers (assignor to himself and William McMillen), Milan, Ohio.

89,277.—Blind-slat Tenoning Machine.—Henry Bickford, Cincinnati, Ohio.

89,278.—Stove-cover Holder.—J. E. Blodgett, Oswego, N.Y. Antedated April 15, 1869.

89,279.—Method of Utilizing the Waste Products of Sugar Refineries.—V. G. Bloede, Brooklyn, N. Y.

89,280.—Stove Governor.—Reinard Blum, Champaign, Ill.

89,281.—Fence-board Gage-holder.—Daniel Bordner, Canton, Ohio. Antedated April 22, 1869.

89,282.—Chain.—J. F. Brewer, Plantsville, Conn.

89,283.—Nut Lock.—Kennedy Brown, Gardner, Ill.

89,284.—Adjustable Gate for Grain Elevators.—Simeon Brown, Utica, Ohio.

89,285.—Composition for Preserving Eggs.—W. C. Bruson (assignor to himself and Geo. Rounds), Chicago, Ill.

89,286.—Burglar Alarm.—I. N. Buck, Elgin, Ill.

89,287.—Hames.—W. H. Bustin, Watertown, Mass.

89,288.—Hames for Harness.—Wm. H. Bustin, Watertown, Mass.

89,289.—Steam-engine Cut-off.—Chas. Carr, Boston, Mass. Antedated April 17, 1869.

89,290.—Twisting and Drawing Heads for Spinning Machines.—Cyprien Chabot, Philadelphia, Pa.

89,291.—Steam Generator.—James C. Cochrane, Rochester, N. Y.

89,292.—Spring-balance Hammer.—John Collins, Parma, Ohio.

89,293.—Velocipede.—Edwin Cowles and George R. Metten, Cleveland, Ohio.

89,294.—Table Car or Caster.—Eli L. Crandall, Williamstown, N.Y.

89,295.—Door Fastener.—W. F. Davis, Boston, and C. E. Broad, Milton, Mass.

89,296.—Track Cleaner.—Augustus Day, Detroit, Mich.

89,297.—Swing.—C. M. Dillon, Philadelphia, Pa.

89,298.—Machine for Cleaning Coffee.—W. H. Elton, Baltimore, Md.

89,299.—Oil Can.—W. A. Fenn (assignor to himself and H. B. Beach), Rochester, N. Y.

89,300.—Animal Trap.—W. A. Fenn, Rochester, N. Y., assignor to H. B. Beach, Meriden, Conn.

89,301.—Gate.—Benjamin Franklin Fisk, Fredonia Township, Mich.

89,302.—Felt Suspender End.—T. J. Flagg (assignor to "Fisk, Clark & Flagg,") New York city.

89,403.—Culinary Steamer. — Israel Forman, Fairmount, W. Va.

89,304.—Stove Grate.—Calvin Fulton (assignor to N. H. Galusha), Rochester, N. Y.

89,305.—Fly Trap.—Benjamin Glasscock, Hillsborough, Ohio.

89,306.—Trestle.—Jonathan Goodher, Burlington, N. J.

89,307.—Book Holder.—W. D. Gridley, New Britain, Conn.

89,308.—Electric Signal for Railroads.—Thomas Hall, Boston, Mass., assignor to himself and William Dillon, Stamford, Conn.

89,309.—Fishing Torch.—George Haneline, Akron, Ohio.

89,310.—Oscillating Furnace for Puddling and Refining Iron.—John Heatley, Etna, Pa.

89,311.—Compound for Forming Building Blocks.—Geo. Helm (assignor to himself and John Ruchty), Napierville, Ill.

89,312.—Manufacture of Sheet Iron.—C. C. Hinsdale, Cleveland, Ohio.

89,313.—Apparatus for Scouring and Drying Sheet Metal.—C. E. L. Holmes, New York city. Antedated April 20, 1869.

89,314.—Medicine for Cattle and other Animals.—O. E. Hornidy, Chauncy, Ill.

89,315.—Dress Protector for Carriage Wheels.—P. G. Hubert and J. W. Pitney, New York city.

89,316.—Dental Impression Cup and Suction Mold.—G. H. Hurd, Memphis, Tenn.

89,317.—Rocking Chair.—Henry Hursh, Sen., Mansfield, O.

89,318.—Process of Distilling Spirits.—C. B. Jarvis, New York city.

89,319.—Machine for Wrapping Sugar Kisses.—T. Laramie and J. A. Scott, Wheeling, W. Va. Antedated April 17, 1869.

89,320.—Preparation for Raising Bread.—R. P. Leonard, Keene, N. H.

89,321.—Spring-bed Bottom or Cushion.—H. E. Maker (assignor to himself and H. C. Hoyt), Newton Upper Falls, Mass.

89,322.—Hub and Spoke for Carriage Wheels.—J. Maris, Marietta, Ohio.

89,323.—Oyster Dredge.—T. F. Mayhew, Port Norris, N. J.

89,324.—Harvester.—L. J. McCormick, W. R. Baker, and L. Erpelding, Chicago, Ill.

89,325.—Wash Boiler.—T. McMullin, I. N. Mendenhall, and M. Mendenhall, Jr., Osgood, Ind.

89,326.—Machine for Making Tin-lined Lead Pipe.—H. Merrie, Cincinnati, Ohio.

89,327.—Fruit Can.—Henry Mitchell (assignor to himself, G. W. Getzandaner, and J. H. Protzman), Osborne, Ohio.

89,328.—Watch.—C. S. Moseley, Elgin, Ill.

89,329.—MODE OF CONVERTING ARTICLES OF IRON INTO STEEL. —Byron W. Nichols (assignor to himself, Cornelius Aultman, George H. Buckins, Percy S. Sowers, and A. Clark Tonner), Canton, Ohio.
89,330. — PRESERVING FRUITS AND VEGETABLES, AND IN COMPOUNDS THEREFOR.—E. R. Norny, McDonough, Del.
89,331.—DOOR BELL.—O. A. North, New Britain, Conn.
89,332.—LOG BOAT.—Albert Olmstead, Windsor, Mich.
89,333.—GRAIN DRILL.—Henry Paddack and Caswell Hollar, Abington, Ind.
89,334.—GRAIN SEPARATOR.—J. C. Parmater and E. H. Bowen, Vinton, Iowa.
89,335.—TOOL-ADJUSTER FOR LATHES.—L. J. Parsons (assignor to himself and C. S. Bushnell), New Haven, Conn.
89,336.—COUPLING FOR BUGGIES.—L. G. Peel, Preston, Ga.
89,337.—RAILROAD-FARE BOX.—J. J. Phares, Zionsville, Ind.
89,338.—PUMP.—John R. Pomroy and L. J. Walter, Lockport, N. Y.
89,339.—CHAIN-PLATE ATTACHMENT.—T. W. Porter, Boston, Mass., and J. D. Leach and Sabin Hutchings, Penobscot, Me.
89,340.—SAFETY STOVE FOR RAILROAD CARS.—A. J. Pyle, New Galilee, Pa.
89,341.—VELOCIPEDE.—James Rankin, Detroit, Mich.
89,342. — APPARATUS FOR MULTIPLYING PHOTOGRAPHIC IMAGES.—D. W. S. Rawson, Peru, Ill.
89,343.—HORSE RAKE.—Henry Rees, Petersburg, Ind.
89,344. — PUMP VALVE. — Alexander K. Rider, Elizabeth City, N. J.
89,345.—MODE OF PRESERVING TELEGRAPH POLES.—L. S. Robbins, New York city.
89,346.—HORSE-COLLAR FASTENER.—W. A. Robinson, Grand Rapids, Mich. Antedated April 17, 1869.
89,347.—BASKET GRATE FOR STOVES.—Francis H. Root, Buffalo, N. Y.
89,348.—HARVESTER PITMAN.—C. E. Roper (assignor to himself and I. Durlim, actuary of E. Ball & Co.), Canton, Ohio.
89,349.—JOURNAL BOX FOR RAILWAY CARS.—H. B. Rowley, Buffalo, assignor to Carrie R. Laman, Painted Post, N. Y.
89,350.—SEEDING MACHINE.—J. R. Rude, Liberty, Ind.
89,351.—ROLLER FOR PAVEMENT.—E. M. Sealand, Cleveland, Ohio.
89,352.—ANIMAL TRAP.—Thos. Silliman, Three Rivers, Mich.
89,353.—APPARATUS FOR PURIFYING AND RECTIFYING LIQUIDS.—T. R. Sinclaire, New York city.
89,354.—PEN HOLDER.—H. A. Spencer, Cleveland, Ohio, and R. S. Cutting, Providence, R. I.
89,355.—CAR COUPLING.—F. D. Sturges, and Wm. M. Young, Mount Vernon, Ohio.
89,356.—SASH HOLDER.—Geo. A. Sturges, Delhi, N. Y.
89,357.—SEWING MACHINE.—H. L. Swartwout, Chicago, Ill.
89,358.—PAPER FILE.—J. P. Tirrell, Charlestown, and Hiram Whitney, Watertown, Mass., assignors, by mesne assignments, to Hiram Whitney and M. L. Marshall and Company.
89,359.—QUILTING FRAME.—R. C. Tomb, Cedar Run, Pa.
89,360.—PROCESS OF ORNAMENTING SHEET-METAL WARE.—John Toothill and Wm. Toothill, Meriden, Conn.
89,361.—STEAM PLOW.—E. A. Tounley and E. S. Friedrich, Washington, D. C.
89,362.—TREE AND PLANT SPRINKLER.—Hiram Tyler, Gaines, N. Y. Antedated April 15, 1869.
89,363.—TURBINE WATER WHEEL.—Alonzo Warren, Suffolk county, Mass.
89,364.—SHEARS AND SCISSORS.—Hermann Wendt, Elizabeth, N. J., assignors to Henry Seymour and Company, New York city.
89,365.—OPERATING PICKING STAFF IN LOOMS.—J. F. Wicks, Millville, Mass.
89,366.—FEED-WATER FILTERING HEATER FOR BOILERS.—Daniel Wineland, McComb, Ohio.
89,367.—LAMP CHIMNEY.—C. H. Wolcott, Randolph, N. Y. Antedated April 16, 1869.
89,368.—HORSE POWER.—Daniel Woodbury, Rochester, N. Y.
89,369.—PLANE FOR CARPENTERS' USE.—S. W. Woodward, Buffalo, N.Y. Antedated April 16, 1869.
89,370.—PARLOR BATH.—J. R. Worster, New York city.
89,371.—SPARK CONDUCTOR FOR RAILROAD TRAINS.—Reuben Wright, Houston, Texas.
89,372.—BAND CUTTER.—Anton Zwiebel, Burlington, Wis.
89,373.—PIPE COUPLING.—Levi Abbott (assignor to himself and Edwin H. Cummings), Lewiston, Me.
89,374.—HEATING AND COOLING COIL FOR MASH TUBS.—M. J. Allen, New York city.
89,375.—SASH BLIND.—C. H. Anders, Myersville, Md.
89,376.—COMBINED SEEDER HARROW AND ROLLER.—John Anderson, Springfield, Ill.
89,377.—WASHING MACHINE.—J. M. Austin (assignor to himself and J. P. Deardoff), Georgetown, Mo.
89,378.—PUMP.—Salmon Belden, Visalia, Cal., assignor to himself and E. F. Roberts, South Amboy, N. J.
89,379.—REST FOR SHOEING HORSES.—S. S. Blackburn, Fredericktown, Ohio.
89,380.—TOY GUN.—W. I. Blackman, Columbus, Miss.
89,381.—PIANO BRIDGE.—C. W. Brewer, Racine, Wis.
89,382.—NECKTIE SUPPORTER.—Simon Bruhl, New York city.
89,383.—DEVICE FOR DISPLAYING DRY GOODS.—J. D. Chambers (assignor to himself and R. I. Bowlus), West Lebanon, Ind.
89,384.—APPARATUS FOR SWAGING AND WELDING TOE-CALKS TO HORSE SHOES.—Almon Cook, Hillsdale, Mich.
89,385.—WASH BOILER.—Augustus Day, Detroit, Mich.
89,386.—GRAIN DRILL.—H. B. Dean and S. A. Baker, Ludlowville, N. Y.
89,387.—WOOD BENDING MACHINE.—Victor de Lyon, and Valentine Werner, Canton, Miss.
89,388.—HAY LOADER.—Winfield Denton, Iowa City, Iowa.
89,389.—STRAW CUTTER.—Ellis Douty, Collomsville, Pa.
89,390.—APPARATUS FOR COMPRESSING AIR.—F. S. Dumont, New York city.
89,391.—COOKING STOVE.—W. C. Durant, West Troy, N. Y.
89,392.—MILK CAN.—S. J. Dwyer, Albany, N. Y.
89,393.—SYRINGE.—J. J. Essex, Newport, R. I.
89,394.—GAGE FOR SETTING PLANING MACHINE CUTTERS.—Anderson Evans, Cincinnati, Ohio. Antedated April 20, 1869.
89,395.—ROOFING FABRIC.—B. F. Field, Beloit, Wis.
89,396.—CORN HARVESTER.—A. W. Fleming, Springfield, Ill.
89,397.—RAILROAD CHAIR AND TIE.—T. F. Fouts, Albia, Iowa.
89,398.—STEAM PUMP.—W. W. Gilbert, New York city.
89,399.—GOVERNOR VALVE.—W. W. Gilbert, New York city.
89,400.—METALLIC BEAM AND GIRDER FOR BRIDGES.—Jos. Gill, Cincinnati, Ohio.
89,401.—WASHING MACHINE.—David Graves, Spring Valley, N. Y.
89,402.—LIFE PRESERVER.—Alfred Gregory, New York city.
89,403.—STOVEPIPE FOR DECKS OF VESSELS.—John Hall, Boston, Mass.
89,404.—SEED PLANTER.—W. W. Haupt, Mountain City, Texas.
89,405.—MACHINE FOR PICKING HAIR ROPE.—H. R. Hildreth, Lynn, Mass.
89,406.—ELEVATOR ATTACHMENT FOR FANNING MILLS.—Newell Hinman, Sparta Center, Mich.
89,407.—CLEVIS.—G. W. Holton, Berlin, Ky.
89,408.—GAME REGISTER FOR BILLIARDS.—W. A. Hough, St. Johnsville, N. Y.
89,409.—CULTIVATOR.—B. S. Hyers, Pekin, Ill.
89,410.—CAR BRAKE AND STARTER.—C. L. Irving, Indianapolis, Ind.
89,411.—SCREW FOR COTTON AND HAY PRESSES.—J. P. Kintner, Harrison county, Ind.
89,412.—MOWING MACHINE.—W. H. Knight, East Machias, Me.
89,413.—WATER ELEVATOR.—L. M. Knowles, Owatonna, Minn.
89,414.—HARVESTER RAKE.—I. Lancaster, Baltimore, Md.
89,415.—RUFFLING ATTACHMENT FOR SEWING MACHINES.—W. W. Lowerree, Albany, N. Y.
89,416.—DERRICK.—Newton Matlick, Williamstown, Mo.
89,417.—SEWING MACHINE.—T. J. McArthur, New York city.
89,418.—CASTER.—W. C. McGill, Cincinnati, Ohio.
89,419.—CULINARY BOILER.—Lewis McLellan, Gorham, Me.
89,420.—MACHINE FOR WASHING WOOL.—John McNaught, and Wm. McNaught, Jr., Rochdale, England.
89,421.—MACHINE FOR MITRING PRINTERS' RULES.—T. H. Mead, Boston, Mass.
89,422.—CULTIVATOR.—J. B. Moody, Pembroke, Ky.
89,423.—CRANK.—C. T. Moore, Gilmanton, N. H.
89,424.—FARM GATE.—J. T. Moxley, Owasso, Mich.
89,425.—STEEL SURFACED RAILROAD BAR.—Jas. Myers, Jr., Williamsburgh, N. Y., assignor to the Barrons Patent Steel Manufacturing Company.
89,426.—BLANK FOR STOVEPIPES.—Edwin Norton, Toledo, Ohio.
89,427.—QUILTING FRAME.—Josiah Odell, Petroleum Center, Pa.
89,428.—STEAM-ENGINE PISTON.—Wm. Ord, Brooklyn, Ohio.
89,429.—ANIMAL TRAP.—D. J. Owen, Springville, Pa.
89,430.—BEVERAGE FROM SOUR OR BITTER ORANGES.—P. G. Pearson, Jacksonville, Fla. Antedated April 20, 1869.
89,431.—SOLDERING APPARATUS.—Charles Pratt, New York city, and Conrad Seimel, Greenpoint, N. Y.
89,432.—SUBSOIL-PLOW.—J. B. Pullman, Los Angeles, Cal.
89,433.—MACHINE FOR MAKING PAPER BOXES.—B. F. Quinby (assignor to himself and G. W. Quinby), Boston, Mass.
89,434.—QUARTZ CRUSHER.—Jos. Repetti, Philadelphia, Pa.
89,435.—PROPELLING APPARATUS.—Peter Robert, New York city.
89,436.—WIRE BRACKET.—W. W. Russell, Ludlow, Vt.
89,437.—DEVICE FOR TRANSFERRING FREIGHT ON RAILWAYS. —L. Savage, Ashtabula, Ohio. Antedated April 16, 1869.
89,438.—PROCESS OF HARDENING TALC, STEATITE, ETC.—J. F. Sell, Cambridge, assignor to Chas. Houghton, trustee, Roxbury, Mass.
89,439.—BLIND SLAT FASTENER.—Wm. Sellers, New York city.
89,440.—DISH STAND.—Daniel Sherwood, Lowell, Mass., assignor to Woods, Sherwood & Co.
89,441.—METALLURGICAL PROCESS AND FURNACE.—Charles William Siemens, Westminster, England.
89,442.—BRIDGE.—Frederick H. Smith, Baltimore, Md.
89,443.—VELOCIPEDE.—William H. Smith, Newport, R. I.
89,444.—COAL HOD.—John G. Somes, Charlestown, Mass.
89,445.—TAKE-UP MECHANISM FOR LOOMS.—John Sparks, Concord, Ky.
89,446.—EMBROIDERING ATTACHMENT FOR SEWING MACHINES.—Joseph Thomas, New York city.
89,447.—MAIL BAG FASTENING.—J. A. Truitt, Oakland, Pa.
89,448.—MACHINE FOR GRINDING CIRCULAR SAWS.—Stephen D. Tucker, New York city.
89,449.—STILL.—Joseph R. Van Marter, Lyons, N. Y.
89,450.—MACHINE FOR MAKING COVERED BUTTONS.—Wm. W. Wade, Medford, Mass.
89,451.—SHOE NAIL.—Aaron Waldron, Milford, Mass.
89,452.—EAR-DROP SUSPENDER. — Linus Weed, Norwalk, Conn.
89,453.—DIVING BELL.—John A. Weisse, New York city.
89,454.—ANCHOR.—Frederick Wittram, San Francisco, Cal.
89,455.—HOSE COUPLING.—Albert F. Allen, Providence, R. I.
89,456.—NOZZLE FOR HOSE PIPES.—Albert F. Allen, Providence, R. I.
89,457.—REVERSING GEAR FOR STEAM ENGINE.—Arthur M. Allen, New York city.
89,458.—HOT-AIR FURNACE.—Charles Allen, Hartford, Conn.
89,459.—BLACKING BRUSH.—C. L. W. Baker, Hartford, Conn.
89,460.—NUT LOCK.—Wm. E. Ball, Belmont, Ohio.
89,461.—WRENCH.—George W. Bishop, Stamford, Conn., assignor to the New England Manufacturing Works Company.
89,462.—AWNING.—Henry A. Bowman, Worcester, Mass.
89,463.—HEATING STOVE.—Theodore Brockman, Davenport, Iowa.
89,464.—BUTT HINGE.—Michael Bush, Bloomington, Ill.
89,465.—WHIP SOCKET.—J. A. Caldwell and C. S. Bugbee, Springfield, Mass.
89,466.—MACHINE FOR CUTTING AND THREADING PIPE.—William D. Chase, New York City.
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REISSUES.

20,885.—STEAM ALARM.—Dated July 6, 1858; reissue 3,400. —Henry Martin, Wallingford, Conn., assignee, by mesne assignments, of S. W. Warren.
28,207.—AXLE FOR CARRIAGES.—Dated May 8, 1860; reissue 3,401.—A. E. Smith, Bronxville, N. Y.
10,386.—HEMMING AND CORDING UMBRELLA COVERS.—Dated January 3, 1854; antedated July 3, 1853; extended seven years; reissue 3,402.—Nathaniel Wheeler, Bridgeport, Conn., assignee of Sherburne C. Blodgett.
74,650.—THRASHING MACHINE.—Dated February 18, 1868; reissue 3,403.—A. S. Whittemore, Willimantic, Conn.
34,150.—GATE AND GUIDE OF WATER WHEELS.—Dated January 14, 1862; reissue 1,792, dated October 11, 1864; reissue 3,171, dated October 27, 1868; reissue 3,404.—J. S. Goode and John W. Bookwalter, Springfield, Ohio, executors of the estate of James Leffel, deceased.
23,291.—METALLIC BAND FOR BALING.—Dated March 22, 1859; reissue, 3,405.—George Brodie, Plum Bayou, Ark.
49,962.—HARVESTER.—Dated September 19, 1865; reissue 3,406.—Division A.—M. G. Hubbard, Syracuse, N. Y., assignee of L. M. Batty.
49,962.—HARVESTER.—Dated September 19, 1865: reissue 3,407.—Division B.—M. G. Hubbard, Syracuse, N. Y., assignee of L. M. Batty.
77,090.—HOT WATER ELEVATOR.—Dated April 21, 1868; reissue 3,408.—W. E. Prall, Washington, D. C. (for himself), and A. C. Rand, New York city, assignee of W. E. Prall.
85,340.—CLAY MOLD AND PATTERN FOR CASTING METALS.—Dated December 29, 1868; reissue 3,409.—The Metallic Compression Casting Company, Boston, Mass., assignees of J. J. C. Smith.
72,555.—AXLE FOR CARRIAGES.—Dated December 24, 1867; reissue 3,410.—A. E. Smith, Bronxville, N. Y.
13,330.—GRAIN AND GRASS HARVESTER.—Dated July 24, 1855; reissue 832, dated January 3, 1860; reissue 3,411.—Division A.—Daniel Urmy and John Manz, Wilmington, Del., assignees of Jesse Urmy.
13,330.—GRAIN AND GRASS HARVESTER.—Dated July 24, 1855; reissue 832, dated January 3, 1860; reissue 3,412.—Division B.—Daniel Urmy and John Manz, Wilmington, Del., assignees of Jesse Urmy.
23,703.—MACHINE FOR MAKING DRAIN PIPES.—Dated April 19, 1859; reissue 1,897, dated February 28, 1865; reissue 2,841, dated January 14, 1868; reissue 3,413.—B. S. Pierce, New Bedford, Mass., and M. R. Pierce, Woodstock, N. Y.

DESIGNS.

3,450.—TRADE MARK.—H. I. Barbey, New York city.
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3,452.—STOVE.—A. E. Chamberlain and J. B. Crowley (assignors to themselves, O. N. Bush, and F. V. Chamberlain), Cincinnati, Ohio.
3,453.—COOK'S STOVE.—J. G. Clarke, Cincinnati, Ohio.
3,454.—CLOCK CASE FRONT.—B. F. Corban, Bristol, Conn.
3,455.—TRADE MARK.—R. F. Danforth, Cleveland, Ohio.
3,456.—PRINTERS' TYPE.—Herman Ilenburg, Philadelphia, Pa. assignor to MacKellar, Smiths & Jordan.
3,457 and 3,458.—GRINDING MILL.—W. D. Leavitt, New Orleans, La., and Henry Shaw, Cincinnati, Ohio. Two Patents.
3,459.—HEARSE.—Henry Loehr, Boston, Mass.
3,460.—STOVE.—John Rowe, Cincinnati, Ohio.
3,461.—GRINDING MILL.—Henry Shaw, Cincinnati, Ohio.
3,462.—HINGE.—E. E. Stow, Plantsville, Conn.
3,463.—GRATE FORK.—John Taggart, Boston, Mass.
3,464.—CLOCK CASE.—S. B. Terry, Waterbury, Conn.
3,465.—CASING OF A SODA WATER APPARATUS.—James W. Tufts, Medford, Mass.
3,466.—VENTILATOR DOOR.—M. B. Washburn, Brooklyn, N. Y.
3,467.—FLOOR CLOTH.—J. T. Webster, New York city, assignor to Deborah Powers, A. E. Powers, and N. B. Powers, Lansingburgh, N. Y.
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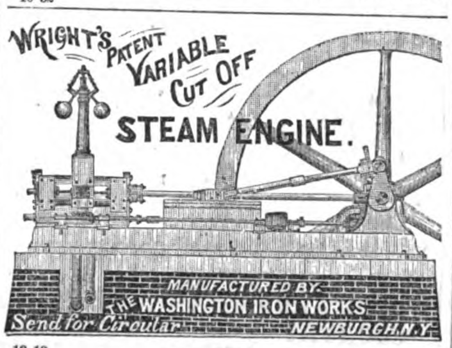

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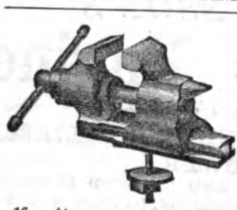

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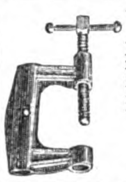

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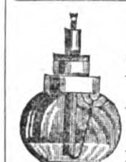

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