with the original supply. Were there a deficiency, the men would be searched; and if the missing gold could nowhere and nohow be found, the whole set of men (as has once happened) would be dismissed.

As a preliminary process to the coining, the blanks are next made to pass through the "marking machine," by which their edges are smoothed and raised. All blanks go through this process, which gives the final edge to bronze coins and to threepenny pieces; the other silver coins, as well as the sovereign and half-sovereign, have a milling put on subsequently. By this time they have become so hardened as to be scarcely workable. To remedy this they are next annealed, and are subsequently cleansed from tarnish or oxide by an acid bath. The effect upon the silver blanks is almost magical. A few minutes in the bath changes them from nearly black to delicate frosted white. A drying in hot sawdust follows, and they are then ready for the final process which will change them from blanks into perfect coins.

Let us follow them to where this transformation takes place. We soon find that we must make the utmost use of our eyes, for the noise is so great that to hear our guide's explanation of what we see is out of the question. The first thing that catches the eye is a solid stone counter, evidently built with a view to immense firmness, which runs the whole length of the room. Along this, at regular intervals, screw-presses of vast strength are at work, having the same up-and-down motion which we saw in the blank-cutting engines. Instead of the punch, however, it is a steel die which ascends and descends, engraved with the device to be impressed on one side of the coin. The reverse die is fixed, immediately underneath, on a solid block, which has to resist the whole pressure (equal to thirty-five tuns) of the descending shaft. Fitting somewhat loosely round this lower die, and rising slightly above it, is a steel collar, on the inside of which is cut the "milling." The huge machine is perfectly automatic. A supply of blanks having been placed in the little funnel which feeds it, a metallic finger places the bottom blank exactly within the steel collar upon the fixed die. The next moment, quietly but with crushing force, the upper die descends upon it. Each die leaves its impression as quickly, and apparently with as much ease, as if the material were hot sealing-wax instead of cold metal. At the same moment the edges of the blank swelling out against the collar, take the pattern of the milling. Simultaneously with the rise of the upper die, a lever causes the collar to sink, the new-struck coin is released, and the arrival of the next blank knocks it off into the receptacle below. The whole process from first to last may have taken three seconds, probably less. The eight presses in this room can, if needful, turn out two hundred thousand coins a day; their average number may be sixty thousand or seventy thousand.

Let us follow the coins one stage further. We find ourselves in a room as quiet as the last was noisy. Yet here too are a number of automatic machines ranged down the middle. They present, however, the greatest possible contrast with those we have just left; for instead of vast strength and power, their characteristic is exquisite delicacy; indeed, each of them works under a glass case, and is not larger than a moderate sized drawing-room clock, though they are worth £250 a piece. But what are they? What are they doing, each with its little pile of bright new money? They are self-acting weighing machines; so accurate and so clever in their working, that one might almost fancy them alive. One by one the coins place themselves on the end of the scale beam, linger a second there, and then drop down a little covered way into one of three boxes—if of the correct weight, into No 1; if too heavy, into No. 2; if too light, into No. 3. A quarter of a grain over or under the standard weight (123,273 grains) is allowed as the limit of variation in a sovereign, and something more in the case of silver money. If the excess or defect be greater than this, the coin is rejected and must be remelted. This happens with about fifteen per cent of the whole.

We despair of conveying any idea of the principle on which these exquisite machines work, without the help of elaborate diagrams.

The finished and perfect coins are put up in ba s of a given weight, ready for the final process of pyxing. This consists in subjecting a couple of coins taken at random, from each bag to a further testing by weight and assay. Now and then the greater "Trial of the Pyx" is held, at which the Lord Chancellor or the Chancellor of the Exchequer presides, with members of the Privy Council as assessors, and a jury chosen from the Goldsmiths' Company. The coins are first tried by weight, and are then melted into a bar, from which the assay trials are taken. A favorable verdict proves that the officers of the Mint have done their duty, and gives a public attestation of the standard purity of the coins.

We may add a word or two respecting the dies used at the Mint, the die-room being generally the last which visitors are shown over. The original die, in hard steel, as engraved by Mr. Wyon, is never used in the coining press. A copy in relief is taken of it in soft steel by means of pressure. This is hardened by some undivulged process, and serves in turn as the matrix for the actual die (*in intaglio*) to be employed. The wear and tear is so great that a die seldom lasts above one day, and sometimes breaks under the first stroke.—*St. James Magazine.*

The Largest Marine-Engine Shop in France.

The most important marine engine manufactory establishment in France is that of M. Mazeline at Havre, and the chief productions of the establishment have been the steam machinery for the following iron-clads of the imperial navy: the iron-clads are the *Couronne, Normandie, Magenta, Solferino, Flander*, and *Heroine.* The *Couronne* and *Heroine* it may be stated, are iron ships, and the only iron ships of the imperial navy, except some batteries, transports, and dispatch vessels. In addition to the steam machinery of those iron-clads, M. Mazeline has furnished the engines and boilers of the *Amazone, Impetueuse,* and *Audacieuse* of the imperial navy. At present there are in hand, in the establishment, the engines for a large frigate building at Brest, and the engines of several small screw vessels.

M. Mazeline's facilities for the manufacture of steam machinery are considerable. Several buildings, detached from each other, cover an area of twelve acres; and, in addition, there is a boiler-making shop in a different locality from the other works. The works, as in like establishments, embrace the machine and erecting shops, founderies, smithery and forge, pattern shop and boiler shop.

The whole of the central or main part of the roof and frame work is supported on two rows of columns longitudinally, and the columns divide the building internally into three separate divisions. They also support the traveling cranes which carry all the heavy weights from end to end of the building. On either side of the columns there is a line of shafting from which all the machines are driven. The center division of the building is the erecting shop proper, with the heavy lathes, boring machines, planing and slotting machines, etc., near the columns; the space between these columns, the whole length of the building, is available for putting the engines and other heavy work together. The arrangement is one of great convenience for moving of heavy shafts, forgings, and castings for the machines, or *vice versa*, by means of over-head traveling cranes.

The machinery, tools, and appliances are of good descriptions, and the work executed is of a high character. Many of the tools are the production of Whitworth & Rigby, of England, but several are the invention and manufacture of M. Mazeline. Among the latter may be named two vertical planing machines, and moving tools, worked by screws, having seven feet stroke. Each of these machines is operated by a small engine, built in the machine frame vertically, so that the machines are not dependent for driving on the other machinery of the establishment. This is a contrivance admitting of application to all heavy lathes, boring mills, planing, slotting, and other heavy engine factory machines. The advantages are, first, the speed of the machine is directed under the control of the workman; second, in the event of any of the machines being operated after the usual working hours, the main engine, together with the whole shafting of the establishment, do not require to be kept in motion; third, accident to the main engine does not interfere with the working of the detached machines. This last advantage will be best appreciated by those who have witnessed the machinery of an entire establishment standing idle a whole hour, while a main belt was undergoing repairs. One of the chief machines in the erecting shop is a great lathe, manufactured by M. Mazeline at a cost of 87,000 francs. This lathe is geared to move at a speed of from three to fourteen revolutions in the minute, and in it at present is an immense three-throw crank shaft for the engines of the large frigate now building. Those engines, it may be stated, have three side-by-side horizontal back-acting cylinders the middle one being used solely for expanding the steam from the outside ones. Of the other machines worthy of note is one for turning the wrists of crank shafts of any dimensions by placing the shaft in a fixed position and revolving movable cutters round the wrists. This arrangement obviates the use of immense costly machines for the work, and saves the power and inconvenience of revolving such great weights from the centers of huges lathes. The dimensions of the building, roughly measured, are 290 feet long by 180 feet wide.—*Dock Yards and Iron Yards of Great Britain and France, J. W. King's Report.*

LAKE SUPERIOR MINING.

The copper of Lake Superior is native, *i. e.*, it is the pure metal, and not an ore—mixed but not alloyed with other substances. There are but two or three ore mines in the Upper Peninsula, and none of them are as yet of comparative importance. The copper is found in different strata of rock, both on the surface and at various depths in the earth. It is deposited in immense masses, in small nuggets, and in grains diffused throughout the rock. The geological laws governing these desposits are complex, and far from being fully ascertained. The belts of rock, in which the mineral is found, are called lodes or veins, these terms being generally used indiscriminately, although there is some slight technical distinction in their meaning. The surface indications of the existence of copper are not very marked and furnish no reliable evidence as to the richness or extent of the underlying deposits. When its copper-bearing rocks are parallel with the adjacent strata, they are said to run with the formation, but when they strike them at an angle they are said to run across the formation, and are called fissure veins.

A high and precipitous bluff, if the indications justify it, is selected for the location of a mine, as greatly facilitating the operations on the surface, and affording important advantages for ascertaining the extent and value of the mineral deposits. A gang of men commence at the top of the bluff, mining downward; digging a pit generally seven by twelve feet in dimensions. This is called a "shaft," and the work of excavation is termed "sinking." A shaft is either perpendicular, or else "sunk upon the vein," that is in the strata of copper-bearing rock when that has been reached, before taking its "dip" or slant. Every mine possesses at least two shafts, and usually more. At a certain depth from the surface, generally about ten fathoms, a tunnel, seven by five feet in dimensions, is started horizontally, running along the vein and connecting with the other shafts. This is called a "level," and the work of excavation in this case is termed "driving." The shafts are some hundreds of feet apart, and when thus connected, a strong current of air blows through the mine giving it thorough ventilation. The work continues still deeper. The shafts are sunk ten fathoms more, and connected by another level, and so on *ad libitum*, and in the mining vernacular these successive galleries are spoken of as the "ten-fathom level, twenty-fathom level, thirty-fathom level, etc." From the foot of the bluff, also, work is generally commenced, and an opening is "driven" horizontally into the rock, connecting with one of the first levels. This is styled an "adit," used for purposes of drainage and ventilation, and often as a means of entrance and egress. The shafts, levels, and adits constitute the mere skeleton of a mine, and this preliminary work, which requires months of labor and immense outlay, is called "opening the mine," and not until it is complete can the production of mineral in any considerable quantities be attempted. The shafts are provided with a series of narrow ladders, each from 30 to 40 feet in length, which are securely partitioned off and firmly fastened, and by which the miners ascend and descend. The shafts are also provided with massive hoisting apparatus, a large bucket being used in case the descent is perpendicular, but a tramway and a car known as a "skip," if it is inclined. Tramways are all placed in the levels to transport the rock to the shafts, provided with small cars. A large pump is carried to the lowest depth of the mine and kept continually in motion, and in occasional cases artificial ventilation is furnished in remote portions by means of air tubes, connected with a fanning machine on the surface.

When the mine has been thus opened and the necessary machinery provided, parties of miners commence to "stope," to remove, by blasting the rock which either surrounds or contains the mineral. "Stoping" is therefore the main business of the mine, to the wants of which all the other operations are subservient. "Stoping" parties, with one of the levels or shafts as their base, take out all the "vein matter," as the copper-bearing rock is termed, leaving here and their natural pillars to sustain the ponderous roof, whose weight, no timbers, however massive, could support. The copper is often found in enormous masses, and then it is handled with great difficulty. It cannot be drilled, and it is too tenacious to be blasted. The rock is therefore removed from its surface as much as possible, and holes are drilled below it. Immense sand blasts, consisting of many kegs of powder, are placed underneath, and by several of these it is torn from its stony fastenings. In the Minnesota mine, a mass of copper was found which weighed 450 tuns, and in one of the sand blasts, which were placed under it, 33 kegs of powder were used. At the same mine, a mass of copper of about five tuns, found some 18 feet beneath the surface was thrown by one of these large blasts through the over-laying earth high in the air, and fell many feet off in a deep ravine. When these masses are too heavy for handling, or too large for transportation through the narrow levels, they are cut up with coal chisels, a tedious but the only efficacious process. The copper is also obtained in small pieces of a few pounds, and this is called "barrel work." Mass and barrelcopper are generally freed from all the rock possible with the pick and hammer, and thus shipped for smelting. The third variety of the mineral is found in small grains scattered through the rock, and this is crushed in the stamp mills, freed from the rock by washing, and shipped under the name of "stamp workr." Considerable native silver is found mixed with the copper, but most of this is abstracted by the miners, and never reaches the company. The Cliff mine, however, obtained $1,800 worth of silver from their stamp work last year. Openings, similar to the shaft, are frequently made for various purposes from one level to another, or from a level to the surface; these are called "winzes." Often, also a species of "level" is started at right angles with the general openings of the mines, *i. e.* running across instead of with the formation of the copper-bearing rocks; this is termed "cross cutting," and is generally used for "prospecting," or determining the character and value of the adjacent strata.

This account would not be complete without some brief allusion to the enormous amount of surface improvement, which is as necessary to the successful prosecution of mining operations as the underground labor. The ground has to be cleared, and houses erected for the accomodation of the officers and employes of the company. Miles of road are made to connect the mine with the nearest port, both to secure supplies and also a market for the copper. Ponderous and expensive machinery must be imported, and stamp-mills machine-shops, forges, kilns, sheds, barns and offices constructed. A large dam must be built to secure constant supply of water to wash the stamp rock. An enormous quantity of fuel must be supplied. Few people realize the tremendious consumption of wood resulting from this cause. The demands of a large mine will clear more than 200 acres of woodland in a twelvemonth. Of course many teams and laborers are required in this department of the business alone Stores, capable of filling the wants of the new settlement, must also be started maintained, and all the chief mines possess their own school house and church. All this must be created from nothing, and in the midst of a barren wilderness. It is only when these things are seen that the beholder commences to realize the enormous capital required for mining operations. The prevalent ideas on the subject are ridiculously absurd, and only those who have personal knowledge can form just connections concerning the matter. Every mine necessitates a village upon the surface, as well as vast underground avenues, and when it is stated that there are nearly one hundred mines on the Lake, the mind begins to comprehend the immensity of copper the interest of this section.—*Merchants' Magazine.*

Correspondence.

Western Enterprise.

MESSRS. EDITORS:—I inclose the amount necessary to renew my subscription for another year.

I find that from among all the papers I take, and I take quite a number, yours commands my first attention and is in fact invaluable, and though I am much occupied in the business of cultivating fruits as well as in the business of building the Chicago and Michigan Grand Trunk Railway, from Chicago via St. Joseph to Port Huron, I always occupy a portion of my time in reading the SCIENTIFIC AMERICAN for I am richly paid.

The road I refer to is one of those that is a practical necessity, and one that will pay on traversing a portion of Michigan now, an average of 25 miles from raiload lines, and a section equal to any in the west for agricultural and manufacturing business. The population in the counties it will pass through, is 55,683 greater than was on the line of the Michigan Central Railroad in 1850, and 107,703 in excess of that on the line of the Michigan Southern Railroad, and to day exceeds that of the Michigan Central Railroad, excluding Detroit, by 25,487. The line is shorter than any other between Chicago and New York, and the work is of the very lightest kind.

Fruit will be plenty here from present appearances. Peach crop here last year sold for over $200,000.

J. P. THRESHER.

Benton Harbor, Mich. Feb. 12, 1866.

The Cinder Nuisance.

MESSRS. EDITORS:—I am extensively engaged in the manufacture of shingles at this point. Burning in my arch, saw dust shavings and etc., all pine. My mill is situated under a hill, on the high ground, and west of my factory are private residences. They complain of the cinders from my smoke stack. I write you for information whether there is any way to prevent cinders, either by burning the smoke or by setting the boiler, or by screens, so as to not destroy the draft. My fuel of course is green. I use a 12 foot boiler with small return flues.

Please answer as early as possible in your truly valuable paper, as the information will be valuable not only to me but to hundreds of others, who desire to carry on manufacturing in cities without any complaint from others. E. H. HOLLISTER.

Rochester, N. Y. Feb. 5, 1866.

[You should use a bonnet on your smoke stack, so enlarged at the top, like a funnel or an umbrella, that the draft will not be checked. You will find several bushels of cinders in the bottom of your smoke box instead of on the neighbors clothes hung out to dry; $3\frac{1}{2}$ x $3\frac{1}{2}$ mesh, No. 13 wire, will answer well.—EDS.

Gear Wheels.

MESSRS. EDITORS:—I have recently observed many articles in your journal, upon setting out gear wheels. Permit me to suggest that the main point is overlooked, which I think is: Are the teeth to be stepped or pitched as chords of the arc, or as so many fractions of the circumferential line?

If the first be correct, the dividers or compasses will be set at the desired pitch at once, and this pitch or chord will be the same for all wheels of the given pitch; and if the latter mode be correct, to get the diameter of a wheel for a certain number of teeth of a given pitch is the simplest matter possible. You multiply the desired number of teeth by the given pitch line, and it will result that the actual pitch stepped off as chords will be different for every different diameter though the nominal pitch be constant.

I have put the above question to those supposed to be well posted, both as mechanics and mathematicians, and I have never yet received either a prompt or positive reply.

I shall be pleased to learn the views of experienced millwrights upon the point. INQUIRER.

New York, Feb. 12, 1866.

Gilders' Composition for Frames, Etc.

MESSRS. EDITORS:—The composition at present in use is composed of best black glue, common rosin and linseed oil. Some use rosin oil, others boiled linseed oil. Nearly every manufacturer has a little change in the proportions, but in Europe, as in America, the above ingredients are those used, and are held as a secret. It is a useful material for many other purposes to which it might be applied were its mode of manufacture known.

Take ten pounds of best black glue, boil it in the usual manner, but with very little water. It should be at least four times as thick as carpenters' glue, as used for general purposes. Take six pounds of common rosin, and pound to dust; add linseed oil, or rosin oil, to form a thick paste with the dust, dissolve with heat, allow it to cool to about 212°, then add the rosin compound and the hot glue together; combine it well. Have sifted whiting prepared and combine the whole as in making bread; form it into cakes, and allow it to cool; at any time by the application of steam or heat, this composition may be brought into use. THOMAS TAYLOR.

Washington, D. C., Feb. 10.

Use of an Invention.

MESSRS. EDITORS:—Will you please throw light upon the following query. A person has invented several machines for expediting the manufacture of certain articles, and has allowed the machines to be used for one or two years in his employers' establishment, but nowhere else. Will such use prevent his securing patents if the articles are patentable. Please answer by letters if agreeable to your rules.

T. J. M.

Baltimore, Feb. 14, 1866.

[If an invention has been in public use for more than two years prior to an application for a patent, a valid patent could not be obtained. The use of the invention in your own establishment could not be regarded as public use within the meaning of the law.—EDS.

Note from Dr. Agnew.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN, of Feb. 10th, I find a report of a lecture recently given by me to home workingmen, "Health, and to How to Keep it." The report is somewhat incorrect, particularly where it says that the British army, in India, lost a brigade a day from the abuse of stimulants, etc. My statement was that, owing to overcrowding in barracks and the large ration of spirits given to the men—6 ounces daily—and want of attention to sanitary policing, the army of 70,000 men lost by death at the rate of a *brigade* A YEAR. A fearful mortality for an army in peaceful camps. The actual death rate produced by the above causes was 69 per 1,000. C. R. AGNEW.

New York, Feb. 10, 1866.

The Principle of the Hydrostatic Press.

MESSRS EDITORS:—Will a tube, say half-inch bore, inserted in a tight, strong hogshead, filed with water, burst open the hogshead upon the tube being filled with water—the length of the tube to be, say, 20 feet or more? An answer will settle a disputed point and oblige A CONSTANT READER.

Baltimore, Feb. 6, 1866.

[A column of water 34 feet in hight exerts a pressure at the bottom of 15 pounds to the square inch, and at other elevations in proportion. If a tube 20 feet long is inserted vertically into the top of a hogshead, and both are filled with water, the pressure at the top of the hogshead will be about 9 pounds to the square inch; and if the hogshead is 4 feet in hight, the pressure at the bottom will be about 11 pounds to the inch. As this pressure is against each square inch, it will be as many times 9 pounds against the upper head as there are square inches in its area; if