THE WORKSHOPS OF CLINTON, MASS.

"You will take the cars to Worcester, go from thence via the Worcester and Nashua railroad about thirteen miles to Clinton, and look at the workshops there. Some of the fabrics produced are in great demand, and the details will be interesting to our readers. Stop in Worcester a few minutes, if possible, and look in at the 'J. Washburn & Moen Wire Works,' then return and report to me."

So said the senior editor of the SCIENTIFIC AMERICAN to one of his associates a few days ago. Acting upon these instructions, we arrived at our destination in due course of time. What we saw in Worcester we shall tell our readers, privately, in another paper.

We found Clinton a flourishing town of some five thousand inhabitants, with as many churches, stores and hotels as are necessary, and several factories, some of them producing goods of a novel character. As our time was limited we went through only a part of them—the carpet factory, the Lancaster Mills, where ginghams are made, and the Clinton Wire Cloth Co.'s Works. In the Bigelow Carpet Co.'s Mills the most attractive sights were the piles of splendid Wilton and Brussels carpets. The variety in color and design was charming, while the ingenuity displayed in the construction of the looms which wove them was equally attractive. To attempt to describe the carpet power loom, invented by Mr. Bigelow, would be useless, therefore we shall not try. The yarn having been put into the loom and the pattern adjusted with it, the whole intricate and marvelous machine goes on and works out the beautiful design, reproducing in a tangible form the inspiration of the artist who made it.

A hasty run through the Lancaster Mills revealed the fact that they are very active, producing goods in great quantity and of excellent quality. We saw here the largest piece of flooring in one unbroken expanse to be found in the country; no less than *two acres* are covered with looms and young ladies. The goods made here are sold in advance of their production, so great is the demand for them.

From the Lancaster Mills we ran over to the works of the Clinton Wire Cloth Co., which are substantial buildings, plainly built and well adapted for the purpose. They are the largest in the world. It would be treading on dangerous ground to describe the machinery, as it was all constructed specially for the Company, comprising some of the largest and heaviest looms and other machinery we have ever seen. The goods made by this company are standard in quality, and much better than those produced by the old processes. Hundreds of different styles of cloth and nettings are manufactured, embracing all varieties that are made from iron, tin and zinc wires.

The reader will be surprised to learn of the extensive use of wire cloth in the arts and for domestic purposes. We have not, indeed, reached that pass where coats and vests can be made of it, but for some domestic uses it has become a necessity, while in the mechanic arts it is quite indispensable. We here refer to a few branches of the work that especially attracted our attention.

In one room was a huge roll of fine window screen cloth for protection against mosquitoes and other insect pests. We thought while examining it that it must be an immense satisfaction to sit in a brilliantly lighted room, protected by this gauze, on a summer evening, and know that in the outer darkness the musquitoes and other winged annoyances were vainly dashing themselves against the iron-clad windows, seeking admittance and finding none, while the air came in as freely as though there was no interruption. Here also was another cloth to protect windows against unruly boys, and strong enough to resist the attacks of a madman; and, in striking contrast, a roll as light and airy in texture as a cobweb. On the other hand were yards and yards of cloth ready for the manufacturers to work into corn poppers, others for rat traps, both of which are made by the hundred thousand feet.

In the next mill was a roll of the most beautiful twilled cloth we have ever seen, almost rivalling the productions of Tiffany & Co. in fineness and its silvery brightness. These cloths are used in the manufacture of the small hemispherical strainers through which tea and coffee is strained. Many grades of cloth are made for use in thrashing machines, fanning mills and other grain assorters. These have meshes mathematically perfect, and separate wheat from oats, rye, corn, peas and other foreign substances, leaving such as are required for the choicest brands of flour.

We were told that the wheat grown in different parts of the country cannot be screened by the same grades of cloth; Southern Ohio and Illinois requiring one grade, Wisconsin and Minnesota an entirely different one, Oregon and other sections still different grades and meshes. Each of the different seeds and grains require special forms of mesh; all of them are made here in the greatest perfection.

Among the heaviest articles fabricated by this company are the locomotive bonnet nettings, for covering the tops of the smoke stacks of locomotives, allowing the smoke to escape but retaining the sparks and cinders. These cloths are intended to embrace everything needed, running from very fine for wood burners, to the coarsest and heaviest "crimped" cloths for the coal burners. Crimped cloths are so called from the fact that the wire being cold drawn, goes through a peculiar process of bending or crimping before being worked in the looms. The patent for the manufacture of this class of goods is owned by this company. The greatest quantity of flour or meal sieve cloth, for domestic use, is made both from annealed and tin-plated wire. Formerly, these goods were bought by the sieve makers in the roll, and by them cut into squares to suit themselves; now, the cloth is cut at the factory by dies into circular forms of exact diameters, and is thus sold to the makers. By this system all the sieves of the country will soon be of the same size. This same grade of cloth is used extensively in the Western States for provision safes.

Neither time nor space will allow us to refer to all we saw in the factory, but we cannot refrain from mentioning the copper-plated cloth for cleaning cotton, and the galvanized cloth for drying wools; they are coming into general use. The galvanized wire fencing, with its neat and tasty hexagonal design, adapted to fencing in lawns, gardens and deer parks, and also for sections of country where timber is scarce. All this and much more we noticed as we wandered from room to room, and saw how deftly the huge machines caught the wires and put them into place, stopping themselves when a single one was broken, and how easily they were put in motion again when adjusted.

Although this company own all the machinery of the kind in the world, still they do not attempt to monopolize the business. They offer the hand weaver better cloths at prices as low as he can produce them, and sell the manufacturer and hardware dealer at a good margin for profit. The company do not make up any goods, but sell in the piece.

In passing through these works we were pleased to note a peculiarity which we wish was more common; everything here moved with the precision of clock work; everything seemed to have a place and to be in its place.

THE BRITISH MINT.

From the earliest times, and among nearly all nations, gold and silver have been adopted as the most convenient form of money. And though, in more than one country, furs have been employed for the same purpose, and in one cubes of hard-pressed tea, and though at this day shells form the currency in one part of Africa, and lumps of rock salt in another, yet the exception proves the rule that among all nations, ancient and modern, possessing any claim to civilization, the precious metals have been, in theory at least, the standard of value and the medium of exchange. The reason of this is tolerably obvious—gold and silver combining a greater number of the necessary qualifications than any other article of value. The material of which money is to be made should be one which every one desires to possess; and though widely distributed, the supply of it should be limited enough to maintain a high relative value, which should be as little subject as may be to variation. It should be as imperishable as possible, and readily divisible into small portions. Its bulk should be small and its value easily ascertained. Gold meets all these requirements, except the last, more perfectly than any other substance, and silver in a not very inferior degree. In addition to all this, gold and silver are almost the only metals found in the metallic state, and when pure are always of the same quality.

The trouble of weighing the uncoined money, and the almost impossibility of testing its purity, must have rendered buying and selling a difficult matter. Both difficulties were overcome by the simple contrivance which gave a government guaranty for the weight and fineness of each piece. The process of coining was at first extremely rough, and the results were anything but artistic. A ball of metal of the required weight and value was placed on the die, which bore the device to be impressed on the coin. A punch was held in one hand against the back of the ball, and struck with a hammer held in the other, till, after repeated blows, the impression was sufficiently worked up. Only one side of the coin, therefore, bore a device; the rough, irregular mark of the punch being all the impression on the other side. The edges, too, were rough and lumpish. Gradually the punch itself came to bear a slight design, till at last another die, equally artistic with the first, took its place.

The present building was erected in 1810, and fitted up with the larger part of its existing machinery. It is situated on the north side of Tower Hill, and may be at once recognized not only by its size but by the soldiers who are always on guard in front of it, as at one of the royal palaces.

In the first room we enter, we may see, if fortunate, the process of melting and alloying. The gold comes in from the Bank in the form of ingots, bearing the name and stamp of the refiner—usually Messrs. Rothschilds'. These ingots weigh 16 lbs. each, and are worth about £800. Half a dozen of these (after having been carefully assayed), along with the proper quantity of alloy, *i. e.*, one part of copper to eleven parts of gold, are melted in each crucible; the crucible itself being made of a mixture of Stourbridge fire-clay and plumbago. When thoroughly melted together (which may be after an hour and a half or two hours in the furnace) the precious mixture is cast in iron molds into the shape of bars two or three feet long. These we may follow into the next room, and see gradually reduced, by repeated rollings, nearer and nearer to the thinness of the future coin. In the case of gold, where the utmost possible exactness is required, each bar (or strip, as it may now be called) has to undergo a more exact adjustment to the required dimensions, by being drawn between two fixed steel rollers, which are placed at precisely the correct distance from each other. The ease and exactness with which this powerful machinery works is truly admirable. It bears the maker's name, "H. Maudsley, 1816," and is still in perfect working order, and scarcely ever needs repairs. As the golden ribbons are turned out by this machine, they are cut into convenient lengths, and a blank coin is stamped out of each and carefully weighed, as a further test that the thickness is correct.

And now let us come into the "cutting-room," where, amid din and noise hardly less than in the "rolling-room," the blanks are being cut out one by one from the golden ribbons. One is reminded of cutting gun-wads from a sheet of pasteboard; and the ribbons, when all the possible blanks have been punched out of them, look like the same sheets of pasteboard when used up, though they are a trifle more valuable! The punches are of course worked by machinery, and there may be a dozen or more of them, incessantly going up and down with almost resistless force, each being a sort of refined edition of the engine which every one must have seen for cutting out rivet-holes in boiler-plates. By the side of each sits a workman with his strip of gold ribbon, out of which he lets the descending punch cut, one by one, as many blanks as there is room for. After we have watched the process for a minute or two, we begin to wonder what check is kept on the workmen to prevent their appropriating a stray blank or two out of the heaps which are lying about in such profusion and confusion. On inquiry we learn that the exact weight of ribbon given to each man is set down; and that not one of the men can leave the room till the weight of the blanks returned, *plus* that of the ribbon waste, is found to tally exactly 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 bags 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,