The Manufacture of Glass.---No. 2.

As the formation of glass is produced by the simple operation of fusing certain minerals together, it follows that the furnaces for fusing, &c., must form prominent features in the manufacture. There are two kinds of furnaces, namely, one called the "Calcar," the other "Working Furnace." There is connected with the furnaces an annealing or tempering oven for the last operation.

The calcar, built in the form of an oven, is used for the calcination of the materials preliminary to their fusion and vitrification. This process is of the utmost importance:—it expels all moisture and carbonic acid gas, the presence of which would hazard the destruction of the glass pots in the subsequent stages of the manufacture, while it effects a chemical union between the salt, sand, and metallic oxides, which is to prevent the alkali from fusing and volatilizing, and to ensure the vitrification of the sand in the heat of the working furnace to which the whole of the materials are to be afterwards submitted.

The working furnace, which is round and generally built in the proportion of three yards in diameter to two in height, is divided into three parts, each of which is vaulted. The lower part, made in the form of a crown, contains the fire which is never put out. Ranged round the circumference inside are the glass pots or crucibles, in which the calcined *materiel* is placed to be melted; and from several holes in the arch of the crown below issues a constant flame which, enveloping the crucibles, accomplishes the process of melting. There are a number of mouths round the outside, through which the calcined materials are served into the crucibles inside. The heat is here so intense that the mouths are provided with movable collars or covers, generally composed of lute and brick, to screen the eyes of the workmen who stand outside in recesses formed for the purpose in the projections of the masonry. The severest part of the work arises when any of the pots or crucibles happen to become cracked or worn out, in which case the mouth must be entirely uncovered, the defective pot taken out with iron hooks and forks, and a new one substituted in its place, through the flames, by the hands of the workman. In order to enable him thus literally to work in the fire, he is protected by a garment made of skins in the shape of a pantaloon, and heavily saturated with water. This strange garment completely covers him from head to foot, all except his eyes, which are defended by glasses.

The material being now melted, is fashioned into the desired forms by the hands of the workmen while it is yet hot, and then placed to cool gradually in the annealing oven. This oven is a long low chamber heated at one end, and furnished with movable iron trays or pans, called *fraiches* (from the French), upon which the various articles are set down, and finally removed, when they are sufficiently cold, through an opening which communicates with the room where the finished articles are kept.

The intensity of the fire requires that the furnaces and crucibles should be constructed of materials the least fusible in their nature, and the best calculated to resist the violent and incessant action of heat; or the manufacturer would incur the most serious losses and delays from casualties which, even after the most careful and costly outlay, cannot be always averted. The crucibles especially demand attention in this respect, in consequence of the solvent property of some of the materials which are melted in them. These crucibles are deep pots varying in size according to the extent of the objects of manufacture; and some notion may be formed of the importance attached to them from the fact that they are not unfrequently made large enough to contain individually no less than a ton weight of glass.

Great skill and care are requisite in their structure so as to adapt them to the temperature in which their qualities are to be tested; and even with the utmost attention that can be bestowed upon them they are often found to break soon after they are exposed to the furnace, by which heavy losses are entailed upon the manufacturer. Nor is this the only point which must be considered. The size of the crucible should bear a proportionate relation to that of the furnace, or one of two consequences, equally to be avoided, will ensue; either that there will be a waste of fuel, if the crucibles are too small, or an inadequate heat, if they are too large.

The initial movement of the glass-blower is to dip a hollow iron rod or tube, about 5 feet long, through the mouth into one of the crucibles containing the melted glass. Having collected at the end of the tube a sufficient quantity of material for the article he is about to fashion—a drinking-glass, finger-glass, jug, or whatever it may be (which requires, perhaps, two or three dips, according to the quantity he wants), he withdraws the tube and holds it perpendicularly for a few seconds with the heated mass downwards, till the fluid drops and lengthens by its own momentum beyond the end of the tube. He then quickly raises it, and rolls it on a smooth horizontal plate till it acquires a cylindrical form. When he has got it into this shape, he applies his mouth to the opposite end of the tube, and blows into the heated mass which swiftly becomes distended into a sphere. But as the globe thus obtained is not rendered sufficiently thin for his purpose by a single blowing, he reheats it by holding it within the furnace, and then blows again, repeating the operation till he brings it to the desiderated size and consistency. Thus prepared, he swings it in the air like a pendulum, or twirls it round and round rapidly, according to the elongated or circular form he requires, the molten particles obeying the tendency of the force and motion employed.

Having advanced to this stage, and the mass being ready for fashioning, a new instrument is brought to bear upon. This is a small solid round iron rod, called the pontil, upon one end of which a lesser portion of material is collected by another workman, and this portion being applied to the extremity of the globe already formed rapidly adheres to it.

The whole is now detached from the tube, or blow pipe, by simply damping the point of contact which causes the glass to crack, so that a stroke upon the tube separates it safely, leaving a small hole in the globe where the tube had originally entered.

By this time the temperature of the mass has cooled down, and it becomes necessary to reheat it, which is done as before. The artificer seats himself on a stool with elevated arms, upon which he rests the pontil, which he grasps and twirls with his left hand, having thus a command over the red-hot glass with his right hand, in which he holds a small iron instrument, called a procello, consisting of two blades with an elastic bow, similar to a sugar tongs. With this little instrument the whole work of fashioning is performed, and as it must be completed while the glass is yet ductile (having always, however, the power of re-heating it when necessary,) the process is effected with wondrous celerity. By the aid of the procello he enlarges or contracts the mass, which he adapts to its motions with his left hand, and where any shapeless excrescences appear, he instantly cuts them off with a pair of scissors, as easily as if they were so much lace or cotton. And thus, almost in less time than it has occupied us in the description, articles of the most exquisite form and delicacy are created by the art-magic of these Vulcans of the glass-furnace.

That which chiefly excites astonishment and admiration in the spectator is the ease and security with which a material so fragile is cut, joined, twirled, pressed out, and contracted, by the hands of the workman. Long practice alone can ensure the requisite certainty and quickness of manipulation, and the eye must be highly educated to its work before it can achive off-hand, and by a sort of accomplished instinct, the beautiful shapes which are thus rapidly produced.

The moment the article is finished, it is detached from the pontil and dropped into a bed of ashes, from whence it is removed while it is yet hot, by a pronged stick or wooden shovel, to the tray to be deposited in the annealing oven where it is gradually cooled, after which it comes out tough and strong.

Without the annealing process glass would be very brittle.

Agricultural Labors of Belgium.

There are two classes of Belgian agricultural labarers. First, there are those who are regularly retained upon the farm, and are lodged, boarded, and paid by the year; to which may also be added other inferior servants, who are not paid by the year, but by the day. Secondly, there are the laborers who live in their own houses, and who are paid by the day for such labor as may be required from them by the neighboring cultivators.

On each farm there are one or more "*varlets de farme*," men who do the ordinary farm-work, plough, sow, and so forth. Of these the superior class receive, in addition to good lodging, and sometimes washing, 200f. per annum. The inferior ones get 150f., or 200f. It should be observed that this is the highest rate, and on many farms the *varlets* do not get more than from 150f. downwards. Next come a class of farm servants who attend to the cows, and who receive about 150f. per annum, with board and lodging. Upon a large farm, however, there are required from time to time more laborers than those regularly retained; and there is another class of laborers who live in their own cottages, and who receive a pretty constant employment in day work, at an average payment of a franc a day. These men are employed in various kinds of hand labor, especially in drain-making, and in some parts they are employed at the harvest time. Women employed as day laborers, but not lodged on the farm, receive from 50c. to 80c. per pay; and children 50c. per day. During the harvest, where wages are paid to day laborers, they range a little higher than usual; for instance, the laborer who ordinarily gets 1f., then gets 1½f. per day. The foregoing account of the rate of annual payment to laborers employed on the farm applies to certain farms held by enlightened cultivators. The general custom is different, and sufficiently primitive to deserve notice. The laborer, according to this practice, acquires a sort of vested interest in the produce of the farm. Throughout the year he is liable to be called upon to do all services directly connected with the crops. At the harvest time comes his harvest also. He cuts the crop; of which he receives the eleventh part, in kind, as his share. He threshes the corn; and for this service (and of course his other work during the year) he receives sometimes the sixteenth and sometimes the eighteenth part of the grain. The sixteenth is given to a few who are employed to thresh very quickly, for the purpose of sowing again. The eighteenth comes to those who are employed more leisurely.

In this practice, which is voluntary, may no doubt be traced the remnant of some abrogated feudal service. Allied as it is with another peculiarity attaching to the Belgian agricultural laborer, it gives him a certain kind of independence, although his fare in general, is miserable and his habitation is far, very far, from being either decent or comfortable. But although this is true, he is nevertheless a proprietor, not in the sense of these pernicious small subdivisions of property which, where they prevail, are the standing obstructions to improved agriculture, but in a way to give him a sense of independence to which the English agricultural laborer is a stranger. The large farms are surrounded—fringed as it were—with laborers' cottages. These are for the most part the property in fee-simple (if the term be known to the Belgian law), of the holder. To each is attached a garden, and frequently a little ground. The garden and the ground, cultivated by the proprietor and his family, yield the vegetables, potatoes, &c., necessary for their subsistence during the year. His share of the crop at harvest time (where he works on that principle) yields him the necessary wheat, &c., and what he does not consume he sells. Those who do no help to raise and reap the crops according to this custom, get their franc a day, which, together with the produce of this little property, and the gains of the youngsters, enables the family to live—that is to say, when things go well. Thus it is not unusual to find a peasant in these parts who is at once proprietor and laborer. A sense of independence (which sits well upon a people naturally courteous) is the natural result. This custom of partition of crops, called "La Dime," like most old customs, stands in the way of agricultural improvements. For instance, you cannot introduce threshing machines consistently with this usage. The larger cultivators, especially those who have received the new lights, are opposed to this costum, and commute the charing system for a regular payment of wages. But at present these are few and far between, and therefore the custom prevails very generally, though the proportion awarded to the laborer differs in different parts; in some being a 20th part for reaping, and a 20th for threshing.

Mahogany for Ship Building.

A very useful little work has been published in Liverpool on the value of mahogany for ship building.

It states that a man of war named the Gibralter, captured from the Spainards, made entirely of mahogany, was recently broken up being 70 years old, and that all her timbers were as sound as the day they were put in, and were afterwards made into tables for the whole British Navy. A ship builder named Chambers, says:—

"I beg to say that I repaired a Spanish brig, about two years ago, which had her sheer-plank and covering-board of mahogany, and most of her upper works. When she was caulked, I found everything good and perfect. I inquired of the captain how long had she been built, and he told me from twenty-three to twenty-four years. I also have in my yard a piece of mahogany, keel of a yacht, which has been under water for at least thirty years, and is as good as the first day it was put to the vessel; and I have seen at Brest, in France a ship-of-war broken up, built entirely of mahogany, and which was upwards of seventy years of age; the timbers were as red and perfect as the first day they were put up; this was about seven years ago. I have, therefore, no doubt of mahogany being as good, if not preferable, for ship building, over any othe wood in the world."

The Liverpool Shipowners' Association recommends mahogany, and state in a letter that "the free and universal use of mahogany, in every part of the construction of a ship, should by all means be encouraged, convinced as we are by the results of very many experiments and long usage, that there is, on the whole, no species of wood (attainable in respect to price) so applicable to ship builders' purposes generally as mahogany, which, for some particular purposes, such as crooks, &c. &c., affords facilities quite peculiar to itself. Its durability, too, seeming to exceed that of all others; it is wholly exempt from dry rot; and from the absence of acid, combines with copper and iron work better than any other wood whatever."

The Messrs Lockett shipbuilders of Liverpool say, "we should prefer it for every part to English oak, as it is not so susceptible of rot, (particularly dry rot,) besides which, iron and copper do not affect it. This we attribute principally to its being free from acid, which is not the case with oak. If we were about to contract with a builder for a twelve years ship, and the regulations would admit mahogany for every part of a vessel, we would give it a preference over every other wood, as we are certain, from twenty years' experience, it is the most durable, besides having the excellent advantage of being much lighter than oak or teak. It has also other considerable advantages, as it can be got in very long lengths for planks, natural-grown croo s, cant pieces, &c., all free from sap.

Here are high testimonials in favor of mahogany as an excellent material for ship-building. It is a great pity that this wood is so expensive, but when the canal is opened through the Isthmus of Darien, we shall have a fine mahogany country opened up to our commerce.

The magnificent steamer Oregon, bound from Louisville to New Orleans, burst her boiler on the 3rd inst., near Vicksburg. The first clerk was killed, the captain was severely hurt, and about thirty persons on board are missing.

New Inventions.

Improvement in Locomotives.

The English engineers are directing attention to the superiority of Crampton's system of building locomotives by suspending on the extremities of the frame. Mr. Crampton places the driving wheel at the end of the engine instead of the centre, and the wheels carrying about one-half of the whole weight of the engine on them, it is clear that one-half will be on the driving wheels; and by assuming four wheels at the other end to take the other half, the machine in fact, is suspended on the extremities; but in the ordinary machine, the driving wheels being in the centre, with half the weight on them, the other half is necessarily equally distributed on the fore and hind wheels, having the effect of a balance beam action—one of the greatest causes of oscillation.

To accomplish the same result, the superintending engineers, Mr. D. Gooch, of the Great Western, and Mr. Sturrock, of the Great Nothern railway, have had their attention directed to the system of suspending their engines on their extremities; and they have succeeded in a great measure, with coupled engines of the ordinary construction, by applying compensating springs, which have the effect, to a certain extent, of placing the weight of the engine on the extreme ends.

Electro-Magnetic Engine.---A New Safeguard Wanted.

The experiments of Prof. Page, of Washington, towards producing an engine of practical utility as a prime motor of galvanic power, and for which $20,000, I believe, was appropriated, appears to have ended in no solid benefit to the cause of science. I have seen it stated that he had an engine which was called a five horse-power, and yet it was only able to drive a small circular saw, ten inches in diameter. This could be done by a steam engine of one horse-power. I have seen it stated that the electrical engine lost speed in a wonderful manner when set in motion to do something useful. What would be the cost of a large engine of 100 horse power, built upon the principle of Prof. Page's, and operated by the same agent? I would say, "judge not lest ye be judged," but upon consideration I believe it would be more wise, and would also exhibit a more becoming spirit of humanity in our Congress, if an appropriation was made for the invention of some plan or plans of safeguards, to prevent accidents on steamboats and collisions on railways. Many such calamities, I believe, can be avoided, for I believe that there are men in our country who, if a reward was held out to them for some new and useful invention for the purpose stated, would direct their minds to the subject, and produce something useful to accomplish the desired objects. S. S.

Philadelphia, 1851.

Collecting Gold by a New Chemical Process.

Prof. Torrey of this city, in a recent lecture, stated that the washing process of gold in California, often results in a large quantity of ferruginous sand, mixed with a large proportion of gold, which cannot be removed by washing. If the mercurial process is attempted, the amalgam will not coalesce, and the mercury can only be recovered by distillation, leaving the gold where it was. Even the expensive solvent, aqua-regia, will not act. But it was discovered nearly a year since, that chloride of lime will take it out as readily as water will remove sugar from sand. From this solution copperas-water will throw down the gold in a metallic powder, perfectly pure.

The latter part we know to be correct, but cannot assert positively that the primary process will do all that has been claimed for it.

New application of the Daguerreotype.

The Waterbury, Conn., American says,—Mr. Hiram Hayden, an ingenious artist of this village, has shown us three landscape views taken by the usual Daguerrean apparatus upon a white paper surface, all at one operation. This is the first successful attempt to produce a positive picture by this extraordinary medium. The pictures exhibit the effect of light and shade, similar to a fine engraving, bringing out the most delicate minutiæ, with the fidelity of the ordinary Daguerreotype.

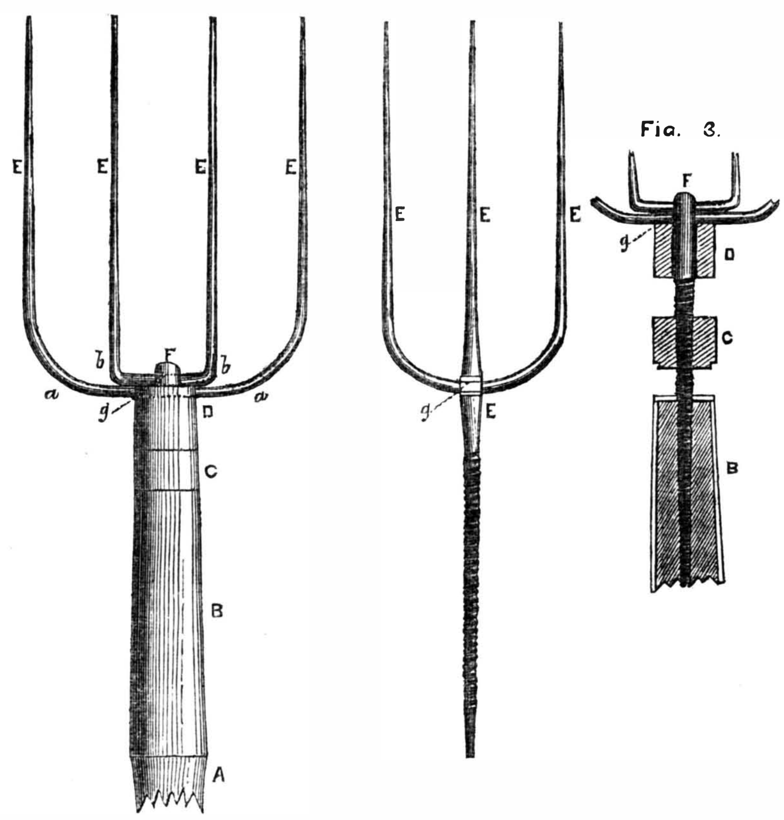
[This is certainly a great discovery. But the puzzling part is to account for the production of pictures on a piece of white paper. What made the shade? That's the query.

Photography---The Whitened Camera.

We find in the last received number of the London Anthenæum a letter from W. E. Kilburn, "Photographer to the Queen," on the subject of M. Blanquart-Everard's new mode of using a whitened instead of darkened camera in taking sun pictures. He says that he has, since seeing the notice of the new process operated daily with a whitened camera "on every variety of subject," and he sends the Athenænm specimens of the results obtained. He adds:—"I support to a certain degree the opinion of M. Everard that his arrangement quickens the process, but not to the extent claimed by him:—and, as a matter of course, it would assist in the formation of an image by light too feeble with the box blackened. I think it is also of service in making very dark shadows less opaque.

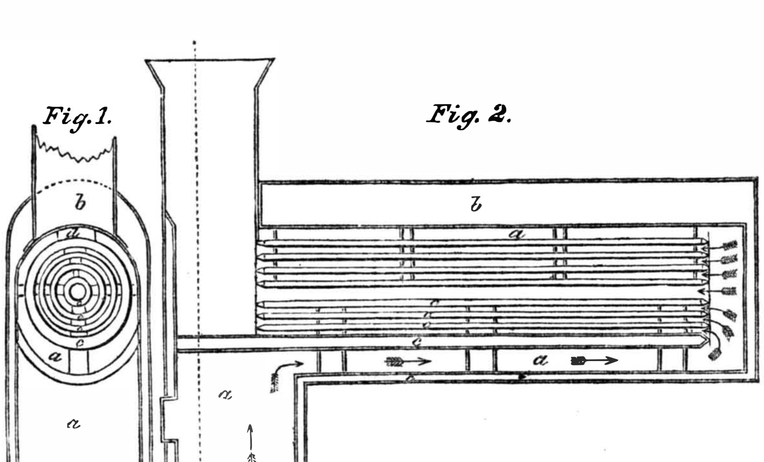
IMPROVEMENT IN AGRICULTURAL PITCHFORKS.

Figure 1. Figure 2.



The accompanying engravings illustrate the invention noticed by us before on page 180. It is the invention of Mr. George Ransom, of Chester, Conn., who has applied for a patent. Figure 1 is a front view of the fork with four tines; fig. 2 shows the manner in which a three tined fork is constructed, and fig. 3 is a jection of a four tined fork. The same letters refer to like parts. This pitchfork is so made that it can be changed from a two to a four tined fork, and *vice versa*, at pleasure. A is the handle; B is that part of the handle which receives the screw shank of the fork; C is a nut, and D is a collar. E E are the tines of the fork; F is a screw rod or shank which fits into the nut end of the handle, A. This shank has an oblong eye (not seen), at *g*, in its side near the outer end. The tines are put through this slot, and the shank, F, screwed into its socket in the handle, thus completely tightening the tines in the eye. It will therefore be readily perceived that two tines can as easily be secured and used in this way as the four tines represented. The bends of the tines are represented by *a a* and *b b*, and they are so made that the tines will go through the eye, *g*, and be turned up with the shoulders in their proper position to be screwed up by the nut, C. The three tined fork is made with the middle tine, E, fig. 2 extended into the screw shank with the eye, *g*, made in it through which the double tines are inserted, otherwise it is the same as the one described. By this description, and the engravings, every person will be enabled to understand Mr. Ransom's improvements; other information may be obtained by letter addressed to him at the place mentioned above.

CHAMPION'S ANNULAR STEAM BOILER.



This boiler is the invention of Mr. Thomas Champion, of Philadelphia, and was secured to him by patent on the 19th of last month; the claim will be found on page 190, Sci. Am. Two views of the boiler are here presented. Fig. 1 is an end view, with the outside plate removed to show the ends of the annular cylinders. Fig. 2 is a longitudinal section. The same letters refer to like parts. The boiler is very simple and will be easily understood by attending to the following description; *a a* represent the fire box, and the arrows in the spaces marked, *a*, show a large fire space nearly surrounding the annular cylinders. The heated air and products of combustion are made to return as shown by the arrows at the back and through the spaces between the cylinders, *c c c c*, and pass up the smoke pipe, thus presenting a large heating surface with return spaces, it may be said to get all the benefit of the fuel. There are a number of large evaporation openings communicating with all the cylinders, but *d* is the upper opening above the annular cylinders, to allow the free using of the steam into the steam chamber, *b*, above. The openings spoken of will be observed more particularly in fig. 1 as extend ing around the cylinders, uniting them together, and answering the four-fold purpose of braces securing the cylinders firmly together, allowing the free ebullition of the water and passage of the steam upwards into the steam chamber, *b*, and also the settling of dirt and impurities to the bottom part, where they may be blown out by a blow pipe, to keep the boiler free from incrustations. They also expose more fire surface, and thereby tend to more rapid evaporation.

It will be observed that this improved boiler has many advantages. According to the space which it occupies, it exposes more than double the amount of heating surface of any other boiler in use. Its form being cylindrical, it embraces strength in its construction, as well as economy of space. Its general construction is such that it affords every facility for a good draught, and Mr. Champion believes that he can save at least one-third of the fuel now used in the best steamship boilers.

More information can be obtained by letter addressed to Mr. Champion, No 465 Callowhill, above 12th street, Philadelphia.

The Patent Office Edifice.

A correspondent from Washington, says "Congress adjourned without granting the request of the Secretary of the Interior in relation to altering the plan of the west wing of the Patent Office Building, for the accommodation of his department. Your article saved the building to the inventors.

It is said that Mr. George Curtis, of Boston, has been appointed Commissioner of Patents"

[We have seen the latter paragraph almost in all our exchanges. We still doubt the correctness of such statements; such action we do not think would be judicious. If we have done any good for the honor or interests of our inventors, we claim no praise—we only did our duty.

Subscribers, Attend!

While we remind many of our patrons that their subscriptions expire with this number, we would also suggest that now is an excellent time for new subscribers to forward their names with those old subscribers who will be remitting their dollar for the balance of the Volume.

For the information of those who may wish to become subscribers, we would say the first half of the present Volume may be obtained by remitting an extra dollar. Any one who may desire to obtain the previous Volume complete [Vol. 5] is informed that we have a few bound copies yet to dispose of, which may be had at $2,75 each; also a few sets in sheets, which may be sent by mail, price $2.

It is an invariable custom of the publishers of the Scientific American to erase every name from the mail books as soon as the time for which subscribers have pre-paid expires, therefore those who commenced with this Volume, and have paid but one dollar, are reminded that their subscriptions expire with this number, and that their papers will be discontinued until further orders, according to previous custom.

Ma ıfacture of Salt in New York.

The whole number of bushels of salt manufactured and inspected on the Onondago Salt Springs Reservation, during the year ending Dec. 31, 1850, is 4,268,919 bushels—814,450 bushels less than in 1849. The decrease the past year is thought to be owing to the very large amount manufactured the previous year.

The cost of salt made by artificial heat at the works, has not exceeded, during the past year, 10 cents per bushel of 56 lbs., including the duty paid to the State; and that of solar salt, 14 cents.