

A QUICK STEREOTYPING PROCESS.

A NEW stereotyping process is described as "almost as quick as lightning" by the *Paper World*. As a matter of every day labor, the "starter," or the number of plates required to enable the pressmen to begin work on the presses, is completed, ready for the presses, in seven and one-half minutes, and thereafter two plates a minute are turned out.

The means by which this extraordinary feat is accomplished are interesting as showing the wonderful improvements in one of the mechanical arts within the last year. Stereotyping is one of the newest of the important arts of the world. In 1850 Kronheim & Co., of Paris, invented the papier mache process, which is the process of pressing a wet, thick, soft sheet of paper into the face of a form of type so as to form a paper matrix of the type. Then this matrix is put into a mould, and melted type metal is poured in, which, when cooled, forms a plate ready for the press.

Until within a few years this paper matrix was built up by pasting several sheets of paper of different qualities together, the inner sheets being somewhat like blotting paper, and the face that was to go against the type very tough and of fine quality. Now a paper is made especially for the purpose, and sold to the publishers in sheets of the size of the pages of the newspaper.

The first to try to introduce the stereotyping process to newspaper publishers was a man named Duncan, who came over from London in 1856, hoping to find America more appreciative than British publishers. He failed because the circulation of American papers did not demand such an innovation, the Hoes having just turned out their first lightning press. It used type, and there was no real need of plates.

A year later, however, the circulation of the *London Times* had advanced so far that the publisher was obliged to set the forms in duplicate, using two of Hoe's mammoth presses. The great cost of a double force of typesetters made the manager ready to listen to an innovator. At that time James Thompson was foreman of the London Newspaper Stereotyping Company, a concern engaged in selling column plates of news to country newspapers on what is now called the patent plan. The *Times* investigated Mr. Thompson's methods, and adopted them, first for the advertisements standing over from day to day, then for wholepages of advertisements, and, finally, for the entire paper. It was considered a triumph of human ingenuity when the work had been so far perfected that two plates were turned out complete in forty-five minutes. The paper did not get to press so early by that forty-five minutes, but the publishers had saved the cost of setting the type in duplicate. The adoption of the system by the other papers of large circulation followed as a matter of course, for even if they did not have to set their type in duplicate, they saved enough in the wear of type to justify the expense, not to mention other advantages of plates, such as the ease with which extra copies can be printed as wanted.

In the early days a matrix which would stand the casting of two perfect plates was considered very good, and one enterprising publisher of New York offered a substantial reward for any one who would produce a matrix that would yield six perfect plates. Now, by a secret chemical process developed by Mr. Thompson, a matrix is made that will turn out sixty plates if needed.

But the most important improvements relate to those parts of the work which consume time between the moment of receiving the type form and the handing of the completed plate to the elevator man to be carried to the press room. Formerly, with a good many motions, consuming much time, the paper was beaten into the interstices between the type with brushes; but now, by the new process, when the form is shoved on to the bed of the moulding press, the type is oiled as before, the prepared paper is laid on, a blanket is laid over all, and the form and bed are rolled between two heavy iron rollers that do in thirty seconds the work which took two men with brushes six or seven minutes to perform.

From this press the form with the matrix on goes to a drying press as before, but, what with steam below the bed and gas jets in the platen, it remains in this press only three minutes.

The matrix is now taken off. It is steaming hot, but stereotypers are the modern salamanders, and do not mind a little matter of handling things heated up to 212 degrees Fahrenheit. From this press the matrix goes to a scorching table, which is one of the important improvements made by Mr. Thompson. It is simply a flat iron table with gas jets beneath which heat the table to a scorching temperature. The matrix is laid back down on this table and covered with a thick asbestos cloth blanket. It remains there while a man may count thirty, and then it comes out done to a turn. Every particle of moisture which remained in it after the drying in the steam-heated process is driven off, and it is simply crispy dry as well as scorching hot. The stereotyper grabs it from the table, and goes on the run to the moulding box, where the cast is to be made.

The casting box consists of two curved iron plates, with shoulders on that shut together in such a way as to hold the matrix against one of the plates and leave space between it and the other plate, so that when the type metal is poured in, a plate of the right thickness is produced. The box is curved because the plates must be curved to fit the cylinders of the press.

It is when casting the plates that the advantages of Mr. Thompson's scorching process are seen. Take as much care as he would in the old way of drying without scorching, the matrix came to the casting box moist, and the first cast was chilled by the moisture and spoiled. As a matter of fact, two casts were generally required to heat up and dry out the matrix. Now, if the man who brought the scorched matrix to the box should stop to blow his fingers to cool them, two others might shut the matrix in the box, pour in the metal, and turn out a completed plate while he was giving his fingers three good puffs.

The solidifying of the metal as well as reducing the temperature to a degree where the plate may be handled has always been done by means of water, formerly by pouring water with a dipper over the convex side of the casting box, but now Mr. Thompson has placed several perforated gas pipes in the concave side of the casting box, and has connected them by means

of a hose with the waters of Croton Lake. A valve is opened and a flood pours through the perforated pipe, cooling all parts of the box at once, and in a fraction of the time required by the dipper process.

The metal used in making stereotype plates is composed of tin, lead, and antimony. If kept at a proper temperature it flows like water, and is perfect for its purpose. But in the melting pots of the ordinary stereotyping rooms, the metal is not always kept at just the right temperature. This is due to the fact that the pot, set in a brick furnace, has the heat applied to the bottom of the pot only. But the new melting pot is unquestionably the best in the country—probably it has no equal in the world. The fire is below the pot, as in other furnaces, but the heated products of combustion, instead of passing directly away to a chimney, must first wind completely around the pot in a spiral tube until they reach the very brim of the pot, when they pass away and up a stovepipe that is 106 feet high, to insure a good draught. Thus the metal is heated at the bottom and on all sides, and is just right when wanted.

RISKS AND APPLIANCES OF FLOUR MILLS.*

By E. W. ARNDT, of Depere, Wis.

EIGHTEEN years in a flour mill, and that during the transition period when old methods and appliances were forced to give way to the new, and the modern mill of to-day grew to be the old style mill of to-morrow, could not but have given me some insight into the increased hazard of the business, wrought by these changes, and has turned my mind to ways and means of reducing to a minimum the conditions favorable to the starting or spreading of a fire.

In the old mill, where the operations were confined to cleaning the wheat, reducing it to flour, bran, and shipstuffs by the one simple application of our old friend, the millstone, and the separation of these materials by the old-fashioned bolting reel, the machinery was not complicated nor crowded. The speed of any shaft seldom exceeded 100 revolutions, and as we all know, the old mills seldom burned, and such a thing as a flour dust explosion was known to but few.

You who were in the business twenty years ago can remember when the companies who now ask four per cent. and five per cent., and often will not insure you at that, willingly accepted two and one-half and three per cent. Can we say that our flour mills have not grown more hazardous, or that it is the unreasonable-ness of insurance companies who have combined to extort from us rates that are greater than the hazard of our mills demands? I think their position was forced upon them by continual losses on flouring mills, to meet which they from year to year advanced rates. The trouble was, they did not meet it in the right way. They established an arbitrary schedule which they applied without a proper regard to the hazard of each mill, their only object seeming to be to make the flouring mills, as a body, make good their losses on flouring mills. The result is that they still continue to lose money on this class of property.

But there was a way out of it that the millers discovered themselves, and that it was a success is evinced by the results shown by the Millers' National Insurance Company, and the millers' mutual insurance companies of Illinois, Iowa, Minnesota, Michigan, Wisconsin, and other States. They have established the fact that flouring mills can be insured as cheaply as in the days before rolls, purifiers, and dust rooms were known. How is this done? Is it a secret? Yes; an open secret. It consists in insuring millsthat come up to a certain high standard, which is not established by the application of a cold-blooded schedule, but by a system of inspection, thorough, full, complete; an inspection that enters into every detail of the business, into every dark corner of the mill, discovers dust piles, hot bearings, concealed bearings, and dangerous machines. Look at one of these inspectors as he emerges from a mill where he has spent several hours. Does not his suit of overalls and jacket of duck covered with flour dust indicate that he has been "through the mill," and not over it?

There are hundreds of mills for which no adequate rate can be obtained. The application of a schedule would rate them low, but a thorough inspection would reject them. I consider that the success of these mutual insurance companies depends more upon the frequency and thoroughness of their inspections than upon anything else. When these inspections were commenced, there was an inclination on the part of mill owners to resent such searching inquiries, and inspectors were put down as fault finders who did not know their business. But of late this has changed; their presence is welcomed, their opinions respected, and their suggestions quickly complied with.

These mutual insurance companies are sometimes styled protection companies, because they adopt as part of their work the improvement and protection of the property they insure. Let us hastily glance at some of the improvements originated and brought about through the work of these inspectors and the companies they represent, though I would not give to them the credit for all such improvements.

That "cleanliness is next to godliness" is an old adage, the force of which at one time seemed to have been forgotten by our millers. It was as hard to convince them that a lack of cleanliness was in any way a menace of danger from fire as it is to convince the average man that a lack of godliness threatens him with the same danger. But even this obstacle has been overcome, and to-day the successful mill is a clean mill.

Elevator heads have been changed so that the strut board is inclined and the heads made self-cleaning. Conveyors have been provided with automatic traps or doors at the point where they discharge, and those not in use disconnected or taken out. Open lights have been abandoned, and inclosed lanterns have been adopted for lighting, metal cans provided for greasy waste and rags, and barrels of salt water and pails have been introduced on every floor. Axes and bars are arranged conveniently. Many dangerous machines have been discovered and the points of danger remedied, while the attention of the manufacturers of these machines has been drawn to the defects, and they have changed the construction so as to obviate the danger. These and many more changes have been brought

about, all tending to decrease the hazard of flour mills.

While this work has been going on, inventors have given their attention to the matter of taking care of the dust from purifiers and wheat-cleaning machines, and to-day we have a variety of machines that accomplish the work satisfactorily, leaving no excuse for the mill that still depends on the old-fashioned cloth dust room.

Out of these, and influences equally potent, has grown the roller mill of to-day, not yet perfect, not yet free from faults, whether viewed from a financial or an insurance standpoint, but still a vast improvement over the mill of ten or even five years ago.

Can I describe such a mill? No; not fully, for there is much that I do not know, but I can give you some points in regard to construction that may be of use to you. Let me picture a mill where, in building to obtain as good results as are possible from an insurance standpoint, none of the essential qualities of a good mill from a financial point is sacrificed. Let the mill be 100 to 200 bbls. capacity. As to the building, I do not agree with the insurance man who asks us to build our mills low and charges us for each additional story over two. I claim that a mill of large capacity that is not over three stories high is a dangerous mill, because of the fact that so much more machinery is necessary, so much more elevating and conveying in order to handle the stock; that while the building may be more accessible in case of a fire, the liability of a fire being started by friction, or any defect in the machinery, is very much increased.

Compare such a mill with one of our more modern structures. The stories of these old mills are generally low, and the machinery necessarily crowded, where you have to either squeeze through or dodge under as you make your way over the different floors. Notice the great number of countershafts, short elevators, and long conveyors; consider the large number of bearings, many of them partly concealed, or located at inaccessible places. My conclusion is, that the height of the building needed for the convenient location of the machinery and the handling of the stock should not be sacrificed to the one point of a low building because of convenience of access at a time of fire. So I would construct it of three stories and a basement. I would make them of the following heights: Basement, 10 feet; first, or roller floor, 12 feet; second, or purifier floor, 12 feet; third, or bolting floor, 20 feet.

If built of brick or stone, the walls should be heavy and ledged for the timbers, or if the ends of the timbers or girders are let into the walls, the ends should be beveled, and cast iron sockets of like shape laid into the walls to receive them. This will prevent the walls being torn down by falling timber in case of fire. Joists should not be used for stringers, but the girders placed sufficiently near together and covered with plank three or four inches thick, according to the weight to be supported. This plank should be dressed on both sides and grooved and tongued. If desired, another floor can be laid on top of this.

The advantage of this kind of construction is that the under side of the floor presents a smooth, unbroken surface between timbers, that can be whitewashed and will long resist the action of fire. The objection to a joist floor is that the joists are but hiding places for dust and dirt, and they afford the necessary kindling wood in case of a fire, giving every encouragement to its spreading.

In providing for wheat storage, I would say that all wheat should be stored and cleaned outside of the mill proper, and only brought in when it is ready for the rolls, but where it is deemed necessary that wheat should be stored and cleaned in the mill, I would put all of the cleaning machinery in the basement, and construct the storage bins in the end of the mill farthest from the bolts and purifiers, building for them a foundation of their own, inside of, and separate from, the foundation of the mill. This will obviate the danger of putting the shafting out of line by alternate loading and unloading of the bins. In the arrangement of the machinery, I would, as nearly as possible, place the bolting reels and centrifugals on the upper floor. The main line of elevators should be at one end of the building, about three feet from the end, extending from the basement to the top of the upper floor. But few elevators outside of this line will be needed. The heads of the reels should of course be next the elevators.

On the next floor below, or the second, should be the purifiers, arranged with their heads toward the tail of the bolts above them. On the next floor below should be the rolls, in line with the elevators. The break reels and flour chests should be on the purifier floor. There will need to be three prominent lines of shafting all running parallel with each other, a roller line in the basement, a purifier line on the third floor, and an elevator line on the upper floor. Gears should be avoided and an upright shaft never used. A mill thus arranged will be light and airy, open to the inspection of the miller as he makes his rounds, easily kept clean, and all bearings will be easy of access.

The stock as it comes from the breaks is elevated to the highest point, and by its own gravity falls from machine to machine without intervening elevators or conveyors, until it reaches the rolls and is by their action reduced still further, when the operation is repeated. I have in mind a mill built in a general way on this plan. It is a first-class mill, doing first-class work, though only of 100 barrels capacity. There are only three elevators outside of the main line referred to, and but two pairs of gears, outside of those on the bolts and purifiers, one of those being the large pair of bevel gears on the top of the water wheel shaft. There is only one conveyor in the mill, four feet long, in addition to those under the reels and purifiers.

There are other details I should advise: A dust collector of some approved pattern on the top of every purifier. Dust collectors for the wheat-cleaning machines, and one, with a suction, for the rolls and stones, if the latter be used. All elevator heads should be hopped, and all conveyors provided with a valve or gate, at the point where they discharge, held closed by a spring, so it will open if the outlet is choked, and close automatically if relieved. The shafting should be heavy enough to prevent springing, and provided with long bearings. Pulleys should be large enough to prevent slipping of belts. Avoid the use of wooden pulleys in elevator heads (iron flanged pulleys are best), and, if used for driving purposes, see that their edges

* Read at the Buffalo convention.—N. W. Miller.

or sides do not come in contact with elevator legs, posts, or other wooden surfaces. Disconnect all conveyors not in use, or take them out, as an unused conveyor, if left running, is a source of much danger.

Right here, a word about the construction and use of fire-proof doors and shutters will not be out of place, as where steam power is used there should be a fire-proof boiler and engine house, with all the openings into the mill protected with fire-proof doors. The best fire-proof door is made as follows: Use two or more thicknesses of tongued and grooved, thoroughly seasoned pine boards. Lay them diagonally across each other and nail them firmly together with wrought nails, well clinched on the opposite side. Cover both sides and edges with the best quality of tin, put on with a lock lap, and nailed under the locking of each joint with barbed wire nails, one inch long. The tin must be made to fit the exact form of the door, so as to leave no air spaces. Where practicable to use them, the sliding door is preferable. They should be hung with wrought iron hangers, bolted on the doors, and wrought iron track bolted through and through the walls, with a guide track below the level of the floor, and should close in a rabbet so as to hold the door in place when shut. The size of the door should be from two to four inches larger on each side than the opening. In case hinges are used, they should be of wrought iron, extending the width of the door, fastened by nuts and bolts, and hung on wrought iron hooks, firmly embedded in the wall. The latch also should be of wrought iron, bolted through the door. Fire-proof shutters should be of the same general construction. This kind of door has been proved to be the best. They will stand an immense amount of heat for a great length of time without warping out of place, as is the case with doors or shutters made of iron.

I have thus given you very briefly, and in rather a wandering manner, a few ideas about the construction and care of flour mills. I doubt not you have all heard it before. I have advanced nothing new. But yet I find in my experience in insuring and inspecting flour mills that old and well-known things are neglected. Familiarity with any danger creates a contempt for it. By the application of this rule we always find that a miller has but a very limited sense of any danger in his own mill, though he sometimes does admit that there is some probability of his neighbor's mill burning. So I would urge you not to depend too much upon your own sense of security. Remember your business is to make money out of the mill, and in these days it takes a concentration of all the energy and wisdom a man possesses to accomplish that, leaving but little time to the thought of how to prevent fires in a mill.

The best plan is to put your mill under the fostering care of some good mutual insurance company, being sure that if their inspectors discover any defects, you should give heed to them. In this way the companies become, as it were, copartners with you, to the extent of your danger from fire, and are interested with you in removing all chances for a conflagration. Remember that as the standard of your mill is improved, the cost of your insurance will diminish, and that your interest will be in the future, as it has been in the past, to sustain these companies.

FIRE APPLIANCES.

Before closing I desire to say a few words about fire appliances in flour mills. If I were confined to but one means for extinguishing fires, I would choose our old stand-by, barrels and casks of salt water, with a plentiful supply of buckets. This contrivance needs no skilled hand to bring it into use. There is no hesitation, no questioning. We all have an inherent instinct that teaches us how to use a bucket of water in case of a fire. Objections urged against them are that the water freezes in the winter, and the pails are always missing when wanted. Let me tell you how to avoid these troubles. In preparing the brine, take a barrel one-third full of salt, to which add about one pound of common washing soda; fill the barrel with water, and you have a mixture that will not freeze nor become offensive, one pail of which is worth a dozen pails of water for extinguishing a fire. Keep the barrel covered. To prevent the pails being carried away, put them on a shelf over the barrel, then take a short piece of rope, nail one end to a post or the wall, passing the other end through the handles and nailing it securely also. No one will take one of these buckets for any purpose except in case of a fire, but when needed a vigorous pull will release them. The buckets should be of galvanized iron, or what is known as a paper or fiber pail. The hoops will fall off from one of the old-fashioned kind, if left in a dry place any great length of time.

I attach great value to a stand pipe and hose, if the pump is efficient, always ready for use, and a proper arrangement of hose provided, in all classes of mills and manufactories, but least of all in a flour mill. My conclusions are drawn partly from observation and a knowledge of such protection being of little or no use at the time of a fire. I know of no class of risks where it is so necessary to be able to use the appliances at hand, without delay, as in a flouring mill, one minute's time lost often turning the scale. A mill is built for the automatic circulation of the stock, and following the line of that circulation, though it is confined in elevator legs, spouts, reels, and other machinery of the mill, is a cloud of dust. Let a fire once start in that line, and we see why it is almost in an instant issuing from every part of the mill. In such a case as this, a stand pipe and hose can be of but little use. If they are used, I would advise that the hose be of rubber-lined cotton, and not over an inch and a half in diameter. At least 50 feet should be attached at each floor, with nozzle. I would not put it on a reel, but prefer a swinging bracket shelf, with the hose laid in layers. Do not use a common globe valve, as there is often delay in opening it. It may be turned the wrong way, may stick, or may be but partly opened in the excitement of a fire. A better contrivance is a lever valve, which can be grasped the instant the nozzle is taken, and without any delay or mistake opened as the man runs with the hose. I find that many flouring mills are burned without the stand pipe and hose being brought into use, chiefly because the millers and employees are afraid of dust explosions, and leave the premises without delay upon a fire alarm being given.

I attach but little value to hand grenades, glass bottles of salt water, and such contrivances. I have seen some very good work done with them at an exhibition,

but they seem to lose their efficiency when most needed, and generally prove a broken straw to lean upon. I think a full system of thermostats would be valuable in a mill. My opinion is that a large number of fires occur from hot boxes, even where the cause is unknown. How many mills are reported as "all right" when shut down at six or twelve o'clock at night, but the fire broke out shortly afterward? I have a large number of such records. You are aware that a hot box will remain hot and seem not to be at all dangerous, until the shaft is stopped, when it will blaze up. I have seen this many times. I would arrange a thermostat at each bearing. I would put them in with a closed circuit so that I would be sure that every thermostat was in working order. On the lower floor, I would put an indicator and an alarm, which would show the location of the hot box, and continue to sound the alarm bell, until the evil was remedied. This plan would not be expensive, and I think would prevent many mills from burning, by giving timely warning of hot boxes, and would thereby remove one of the prime causes of fires in flour mills.

The value of automatic sprinklers in a flour mill is a subject now being much discussed. My opinion is that a thorough system, up to the New England standard, of some reliable sprinkler, placed in a flouring mill so as to thoroughly cover every point, will give undoubted protection. The fact that mutual insurance companies are making concessions in rates, equal to twenty-five per cent., where such equipments are put in to their satisfaction, is evidence of their opinion. But let me ask you here not to be misled by the mere name of automatic sprinkler, lest to your sorrow you may some day find that what you supposed to be efficient protection was but a delusion. There are a number of good and reliable sprinkler heads in the market, but the manufacturers, or their agents, in their efforts to close contracts for the equipment of manufacturing plants, let their zeal run away with their judgment and induce their customers to put in equipments that come far short of being standard. They are deficient to such an extent that the mill or factory so protected is but little, if at all, improved as a fire risk, and the owner not entitled to any reduction of rate because of his outlay.

This is all wrong, and any one contemplating the introduction of automatic sprinklers should insist upon their coming up to the requirements of the mutual insurance companies. Expert inspections of automatic sprinkler risks in the West, put in during the last year, show fully three out of every four as being entitled to no reduction in rate, because of the deficient equipment, and yet, with this unreliable protection, we often find the manufacturer neglecting every other precaution and placing entire dependence upon his sprinklers. I cannot state here the full requirements of an automatic sprinkler equipment in a flour mill; the details are too extensive to be shown in a paper such as this. I would only repeat what I have before suggested, that, as it is chiefly upon the mutual companies you are to depend for concessions in rates, you be sure that your automatic systems come within their requirements. They keep in their employ expert inspectors who are competent to detect any deficiencies in the work, and give you the benefit of their experience. It would be well for you who contemplate equipping your mills to consider this.

GLAZES FOR PORCELAIN WARE.

MM. LAUTH and Dutailly have recently communicated to the French Chemical Society the results of their investigations on the red glazes which are produced on porcelain by means of copper and its salts. The color produced in this manner is of a much more permanent nature and of a far superior tint than that which is obtained when oxide of iron is used for the same purpose. This red color, when used for decorative work on ancient porcelain, is often accompanied with a blue coloring matter beneath the surface of the glaze. It appears that the secret attached to the production of these colors was known only to the Chinese until recently, and that the red, known as *Tsi-houng*, or *sang de boeuf*, could not be imitated by the French at the porcelain manufactory at Sévres. In 1852, MM. Ebelmen and Salvétat endeavored to reproduce these copper colors in France by making careful analyses of fragments of Chinese porcelain colored in this manner, and then imitating, in the composition of the glaze and clay employed, the Chinese specimens. The results of these earlier experiments are now in the ceramic museum at Sévres, and are the first examples of the kind produced in Europe. Other French chemists have since then attempted to improve on the first trials, and the problem has also been attacked by H. Seger, of the Berlin Porzellan Fabrik, and by H. Bunzli, at Krumm, in Austria. MM. Lauth and Dutailly have established by their experiments that the maximum temperature which the Chinese red glazes can stand without losing their color approaches to that used for baking the new Sévres porcelain. By successively associating all the compounds capable of entering into the formation of a colorless glaze with oxide of copper, they have come to the following conclusions: That in the same series of glazes, those which produce the finest red color with copper compounds have the greatest amount of silica present, and that in a series of glazes of approximately the same degree of acidity, the best results are obtained when there is a large proportion of alkalis and a small percentage of alumina. They have further noticed that if the alkaline metals be increased in relation to the alkaline earths present, a finer red is produced, but at the same time the liability to break is increased. By employing boric acid or borates this inconvenience may, in some measure, be prevented. Lime, magnesia, various fluorides, and lead and iron oxides have also been tried; but the results obtained by their use have not proved satisfactory. A very good red glaze can be produced when zinc oxide and baryta are the bases present in the glaze. The copper can be introduced into the glaze in different ways. Oxalate of copper, simply mixed and not fused with the melt, gives good results; but if previously fused with the glaze, very satisfactory colors are produced. The quantity of copper salt employed depends on the time required for baking the porcelain, and also on the temperature of the furnace. Five per cent. is the quantity which is recommended as the most suitable to use, and the addition of a small quantity of

tin oxide is advantageous. The glaze which has given the best results has the following composition:

Pegmatite, 31.17; sand, 36.37; fused borax, 12.98; dry carbonate of soda, 4.76; barium carbonate, 10.39; zinc oxide, 4.33. Corresponding to silica, 61.02; alumina, 5.85; alkaline oxides, 10.72; baryta, 8.42; zinc oxide, 4.51; boric acid, 9.48. This glaze has a degree of acidity represented by the number 5.39, that of the French glaze, No. 1, being 5.14. The bases are in the proportion which corresponds to the formula:



By using this glaze with a similar one containing lime, MM. Lauth and Dutailly have succeeded in obtaining a great variety of colors on the same material, and in producing some effects on porcelain which have not hitherto been achieved.

HOW BANK NOTES ARE MADE.

It can safely be said that not one out of 100 people who handle bank notes knows how much trouble it takes to make them. The "making" in this case, of course, is understood in the sense of producing the attractive specimens of the engraver's art in green, orange, and black. Otherwise the "making" comes quite easy, far more than the average citizen is aware of. Even the more or less crude work of the counterfeiter is the result of laborious and painstaking efforts of many weeks. In detective stories one is wont to read that artists of the highest standing frequently lend their genius to the production of the "queer," but this is indignantly denied by the legitimate artists.

"During my long career I have heard of but two or three good engravers who had anything to do with counterfeits," said L. J. Hatch, formerly of the government Bureau of Engraving and Printing, and now connected with the Western Bank Note Company. "The good engraver would scorn to engage in such work. His standing as an artist and a citizen is too high for that sort of thing. Moreover, I do not think that there is any one artist who combines in his person the aptness for the three great specialties of bank note work—the lettering, lathe and scroll work and picture engraving. Especially the latter specialty is one in which the height of art is reached by but few. In fact, there are not more than six or eight proficient artists in the line of bank note picture engraving in this country, and their services are so well paid that they would be worse than fools to throw their talents away in criminal pursuits. The bank note as you see it—of course I speak of the design only—is not the work of one endeavor, but of four to each plate at least. Each artist engraves a part of the design, and the different parts or dies are united to one plate by an intricate and delicate system of transferring."

One can readily gain an idea of the minuteness of bank note work when it is learned that it takes a good engraver from twenty to thirty days to complete the vignette—portrait or scene—alone. Take for instance General Grant's portrait in the vignette of the \$5 silver certificate, the counterfeit of which is just now the talk of the city. A careful scrutiny by means of a magnifying glass will disclose that the work, which upon first glance impresses one as the result of miniature portraiture in ink, consists of a multitude of delicately engraved lines and dots, which can only be produced by the aid of a magnifying glass.

"Each portrait requires a different combination of lines and dots to harmonize with the features of the man portrayed," continued Mr. Hatch, speaking in the *Chicago Herald*. "There is no system of portrait engraving. If an artist would attempt to employ a settled method, he would distort the features. In fact, each engraver puts his own individuality into his work, and his production is as characteristic of him as the signature is of a writer. So much is this the case that one engraver in this line will be able to tell the work of another at a glance. For this reason the counterfeiter encounters insurmountable difficulties in copying a vignette, unless he discovers some mechanical method, like photographing, litho-engraving, or electrotyping, and these aids of the counterfeiter are, of course, at once apparent to the expert. The counterfeiter who copies a portrait by hand cannot keep his individuality out of the work."

"Picture work requires the highest grades of engraving. The artist has not only to produce light and shade, but he must understand how to harmonize lines in order to obtain what is called a 'speaking likeness.' In this respect the engraver's art is not unlike language. You may express the same idea in different words which expresses the idea exactly, beautifully, not a word too much nor one lacking. Thus there is but one harmony of lines and dots which makes a correct portrait. To copy such portrait by hand without the copyist being able to transplant himself into the creative individuality of the original artist is preposterous. That is the reason why the inferiority of a counterfeit is nearly always first observed in the picture work. Where there is one picture engraver, there is a handful of letterers."

Truly, the lot of a bank note engraver is that of a patient toiler. Day after day he plods away with his assortment of diamond pointed gravers, some of them as fine as the finest needles. Line by line and dot by dot he carves into the shining steel plate before him a miniature of the design to be reproduced. The days lengthen into weeks and the weeks into months before his work is finished, yet each line and dot is of his own creation, until all the minute carvings blend into one beautiful production—a speaking likeness of the design, and still so widely different in the execution. That part of the plate, however, is not the one from which the note is printed. The lathe worker and the letterer have been busy on their parts of the design while the portrait engraver was working, each artist working on a separate piece of steel. These pieces are hardened and form the die. From the latter the design is transferred to a steel roll of softer nature by applying an immense pressure, actually impressing the design of the die to the roll, on which of course the parts sunk in the die will be elevated and the elevations depressed. This part of the work, though mechanical, requires the greatest degree of nicety and exact adjustment of parts in the complicated machinery. Its results, speaking by comparison, are to a stereotyped matrix what a steel engraving of modern times is to an ancient woodcut. The steel roll, containing now what may be termed the