

THE AMERICAN PLATE GLASS INDUSTRY.

The manufacture of plate glass has attained great development in recent times. It is a striking fact that a material so easily manipulated as glass in the molten state only yields its finest product, plate glass, to the operations of slow mechanical grinding and polishing. We present in this issue some illustrations of the operations of rolling, grinding and polishing plate glass as conducted in the works of the Pittsburg Plate Glass Company, in Creighton, Pa. This company stands as a representative American manufacturer of plate glass, its works being among the largest in the world. The drawings were prepared on the spot by our special artist.

The material for the plate must be of the utmost purity. The great point is to secure a product that will be as nearly colorless as possible, the degree of color being revealed by the appearance of the glass when looked at edgewise. The chemist who has used the blowpipe knows how slight a trace of impurity colors glass. The material for melting is made up of the purest sand—the famous Pittsburg sand being largely used—lime or soda ash, and other constituents, together with a quantity of scraps of glass, "cullet," as it is called. The whole is melted down in large pots of one ton capacity each, many hours being required for the complete fusion.

The first operation after the glass is melted is the rolling. The rolling table is shown in our illustration. It has an iron bed and two rollers are arranged to traverse its surface. The thickness of the glass is regulated by strips of iron which run along the edges of the table, on which strips the rollers rest. The table is mounted on wheels, so that it can be drawn on tracks from one part of the glasshouse to another. A movable crane is shown, which lifts and transports the pots of melted glass. The object of having the table movable is to be able to bring its end opposite the mouth of any of the leers or annealing ovens.

The pot of glass being withdrawn from the furnace, is gripped by the tongs, as shown, and is lifted and brought over the table by the crane. The glass is poured out in front of the roller, the crane being slowly drawn across the table during the pouring, in order to distribute the glass. Glass is never perfectly liquid; so as it falls upon the table it lies in an irregular heap in front of and against the roller. When it is all poured the roller is drawn over it, pressing it down and forming an irregular sheet. For some reason irregularities of wave-like shape form in the glass. To remove these the small roller is drawn over the yet plastic sheet.

Referring again to the cut, in the background are seen low arches. These mark the openings of the "leers" or annealing furnaces. The table is brought exactly opposite one of the doors and the great plate, now somewhat cooled and hard, is drawn into the hot oven. The door is at once closed, and the heat is gradually reduced. The plate lies flat on the bottom and takes the contour of every irregularity thereon, so it is necessary to have as true and smooth a bottom as possible. A day or more may be required to anneal a plate. The plates are rolled of different thicknesses, about 60 per cent being allowed for waste; a plate 9-16 inch thick as rolled is ground down to ¼ inch thickness.

The rough plates as removed from the annealing furnace are trimmed off to the best advantage, the presence of cracks and imperfections determining the lines of cutting. They are then mounted in plaster of Paris on the circular revolving table of the grinding machine shown in one of the cuts. Immediately above and resting on the glass are two iron disks free to rotate about their centers. The circular table is turned by power. Its periphery moving faster than its central portions keeps the two iron disks in slow rotation. A stream of sand and water is fed to the machine, and the sand is changed to finer and finer grades, during the progress of the grinding. At last fine emery is substituted for sand, and this is the last phase of the grinding of the surface. The plates are then removed and reset with the other face uppermost and the process is repeated for the unground face. The next and last step is the polishing.

This is executed by felt buffers, weighted so as to press upon the glass. The buffers are held in a rectangular frame. The workman feeds the whole surface of the glass with rouge and water and the buffers are started into action. The glass is slowly moved back and forth under the reciprocating buffers, so that all parts are reached. One side and then the other is thus brought to a high polish, and the glass is finished.

The Pittsburg Plate Glass Company have three works, with an aggregate capacity of 340 tons per day, or 8,000,000 square feet per annum. They are situated at Creighton, Tarentum and Ford City, in Pennsylvania. The Ford City works have 600 acres of ground, with a river front of 2¼ miles, and the buildings are ½ by ½ mile in area. Utilizing natural gas, the company has 150 miles of main laid to supply its furnaces. At Wyandotte, Mich., they have a chemical works where they manufacture their own soda ash. Even the rouge,

made by igniting copperas, is manufactured at their own works. They have fifteen sand-digging scows and four steam tugboats. They produce sheets 144 by 221 inches or 12 by 18 feet in size.

Evolution of Bookmaking.

The interior arrangement of books has undergone many changes in the progress of time and events. At first the letters were divided into lines only, then into words, and these, by degrees, were noted with accents, periods, paragraphs, chapters, and other divisions. The severe conditions and penalties attached to the loan of a book in the old days before the art of printing was known can be readily understood when we consider how the books were written. If copies of a work were desired, the monks, who were almost the only persons who could read and write, were collected together in a room, and while one of them read a line the others, to the number of ten or a dozen, each wrote it, so that when they were through they had as many copies completed as there were writers. The early poets and orators recited their effusions in public to induce their hearers to buy written copies of the poems or orations.

It seems that the very earliest books were printed, not with movable types, but from solid wooden blocks, remarks Mr. A. H. Griffith, in the *Detroit Free Press*. These consisted of a few leaves only, and were mostly pictures of saints or historical persons, with a text or a few explanatory lines. The ink was of a brownish hue. These are known as image or block books. The pages were printed on one side only, though often two leaves were pasted together, back to back. In many of the first books blank spaces were left for the capitals and first letters; these were put in by hand and in the most beautiful designs and workmanship. The earliest known book of any magnitude is the famous Mazarin Bible, so called because of the copy found in the library of Cardinal Mazarin. The work is without a date, but authorities generally concur in ascribing it to about 1450. There are known to be about twenty copies in all of this work. Many queer books have appeared at different times and created widespread interest or public condemnation. Among the most celebrated of modern times is perhaps the *Book of Mormon*. This book was revealed to Joseph Smith, so he said, in a dream when the Angel Moroni appeared to him three times and told him that the Bible of the Western Continent, the supplement to the New Testament, was buried in a certain spot near Manchester, N. Y. Thither, after four years of preparation, this same Smith claims he went, and had delivered into his charge by an angel a stone box, in which was a book made of thin gold plates, about seven by eight inches in size, fastened together by three golden rings. The plates were covered with characters said to be reformed Egyptians. This book professed to give the history of America from its first settlement by a colony of refugees, who were among those dispersed by the confusion of tongues at the Tower of Babel. Accompanying this book was a pair of spectacles, consisting of two crystals set in a silver bow. By the aid of these Smith proceeded to translate the mystic characters. That the whole scheme was the work of an ignorant person is well known, and I only speak of it as a matter of interest connected with the history of books.

Primitive binding had no object beyond that of preserving the book, but it was not long in use before it became associated with ornament. First a small tablet of ivory or wood, on which was written the title of the work, was put on the side. Then a piece of leather was stretched over the edge to protect it from the dust and to keep this in place, it was tied with a cord or strap, but these were inconvenient and were in time replaced by clasps which were of silver, gold, and other metals, often enriched with settings of precious stones, cameos or ivory carvings. Of course this work was more strictly speaking that of the jeweler and goldsmith, for the binding only fastened the leaves together and placed them between two boards which were covered with leather or other material, and as the books were intended to lie flat, one on top of the other on the shelves, they always studded around the edges with nails whose round projecting heads preserved the flat surface of the binding from being rubbed.

The crusades, which introduced into Europe many luxurious customs, must have had great influence on bookbinding, since the Arabs had for a long time known the art of staining, dyeing, stamping, and gilding the skin they used for covering their books. After the invention of printing, books multiplied more rapidly. Their weight and size were greatly reduced and they ceased to be of such ornamental value. The binding became less bulky, cardboard took the place of wooden boards and this was the beginning of modern bookbinding. The binder, like the shoemaker, may well say there is nothing like leather. Charlemagne granted a charter to the monks of Sithen by which they were granted the unlimited right of hunting deer on condition that the skins should be used in making gloves, girdles, and covers for books. The ornamentation was almost entirely in blind

tooling, for it was long before the gilder's work became general. Italy set a fashion of beautiful bindings copied from those of the Koran and other Arabian manuscripts, which the bold Venetian navigators brought back with them from the East. While the art of beautiful bookbinding was born elsewhere, it seems to have been cradled in France. From the beginning of the sixteenth century to the middle of the eighteenth, fostered by the kings and queens and rich collectors of that country, the art reached and maintained a degree of excellence which has never been surpassed. In the old days the binder performed all the different processes himself, even to the making of the tools he used. The work being his own, from beginning to end, it bore the stamp of his individuality. Not so to-day. Now it is a combination of trades. One man sews the leaves together, another prepares and puts on the covers, while still another ornaments the backs and gilds the sides. One of the strange facts in history is that the inventor of bookbinders' glue was an Athenian. He used it to fasten sheets of parchment together, and so highly was his invention appreciated that the people of Athens honored him with a statue, a form of compliment rarely accorded to any save the winners of the Olympian games and men who had performed deeds of valor in war.

To-day the bookbinders of the world are indebted to American ingenuity for three-fourths of the machinery used in the work, and, while French bindings excel in taste, English in solidity and strength, the Americans excel in the rapidity of their workmanship. If the American workman would apply the skill and painstaking labor that the French artisan devotes to his work, we should soon develop a national type of industry which would astonish the world.

Frozen Water Closets.

The discomforts, not to say dangers, which attend the freezing of water pipes are alone hard enough to endure; but when the frost is so severe and stays so long with us as to lead to the stoppage of soil pipes we are brought face to face with a new evil which demands very prompt and careful action. We learn that in many houses in the suburbs of London this has occurred, and that in many cases the occupiers have been obliged to carry the excreta into the garden or to avail themselves of the premises of an obliging and more fortunate neighbor. When the thaw does set in, the consequence of this condition of things may be very serious, and those who are unfortunate enough to be in such an unenviable position should have a stock of some efficient disinfectant at hand. It would be a proper and useful preliminary precaution to place a quantity of disinfecting liquid, such as carbolic acid, in the pan of the frozen closet. The public health authorities might, we suggest, help the people in this matter, so that pestilence and disease may not be counted among the contingencies which prolonged frost brings in its train.

[The above, from the *London Lancet*, suggests that the same precaution against the danger arising from frozen pipes is as important to our people as to Londoners.—Ed.]

The Natural Bridge of Oregon.

One of the chief of the west coast natural curiosities is the "Titan's Bridge," situated in Douglas County, Oregon, and about eighteen miles from Oakland. It is not on such a grand scale as the famous "Natural Bridge" of Virginia, but will, when its whereabouts become generally known, rank high among American oddities of nature. This Oregon natural bridge was discovered only a few years ago by a Californian of the name of Magee. The canon spanned by its arch is 91½ feet wide at the base between side walls, and the arch itself only lacks 4½ feet of being an even 100 above the little stream that runs beneath. The rock stratum which spans the canon and forms the bridge is 30 feet in thickness, exclusive of 3 or 4 feet of earth, which supports a few straggling trees. It has already become a great resort for Oregonian outers, and a large hotel on a plateau near the western approach of the bridge is among the near future probabilities.—*St. Louis Republic*.

The Flyer.

Out in the State of Washington there is a steambot which lets no grass grow under her feet (if the Hibernian editor may be allowed a figure of speech). It is the Flyer, a screw steambot, 200 feet long, carrying passengers on Puget Sound. She ran 68,695 miles during the year 1894, which is believed to be one of the best records ever made by a boat of that kind. This vessel, which belongs to the Puget Sound and Columbia River Transportation Company, makes four round trips daily between Seattle and Tacoma, 27½ miles, or 220 miles a day. The round trip of 55 miles is made in three hours. The distance between these two cities by rail is about 40 miles, but the Flyer makes such good time and is so punctual that she is said to be more popular than the railroad trains. The aggregate of lost time during the year is said to have been only 43 minutes.