

lighted, mined, pumped and ventilated by electricity; to the works of the Etna Spring Iron and Steel Co.; to the Westinghouse Electric Co.; the Sable Iron Co.; the Pittsburgh Steel Casting Co.; the Carbon Iron Co.; the Pittsburgh Reduction Co., and numerous other establishments which contribute to make Pittsburgh so interesting a field for investigation to metallurgical workers. In his address of welcome to the visitors, Mr. Ricketson gave some idea of the extent of these interests when he spoke as follows of the resources of Pittsburgh: We have twenty-one blast furnaces, which in 1889 produced 1,293,435 tons of pig iron; thirty-three rolling mills, twenty-seven of which roll steel, and their production in 1889 was 1,105,573 net tons of steel, and 638,450 tons of rolled iron. Our annual capacity of steel rails is at present 550,000 tons. Our product of wrought iron pipe this year will, I am told, not fall short of 250,000 tons, while our output of structural iron and steel will be fully 165,000. We have forty-nine iron foundries, representing a capital of nearly \$10,000,000. The principal electrical industry in Pittsburgh is in apparatus for incandescent lighting. Of the dynamos in the United States, having the capacity for the supply of current for 1,500,000 sixteen-candle power lamps, Pittsburgh alone has furnished 650,000 of this, or nearly 44 per cent. We have fifteen firms or companies making window glass, thirty-seven making flint and lime glass, and fifteen making green and black glass bottles. The 15,000 coke ovens in this district consume 9,000,000 tons of coal in making their product of about 6,000,000 tons of coke. The railway tonnage of Allegheny County, of business originating here, exclusive of what passes through, is 20,000,000 tons per annum, or a little more than 3 per cent of the total railway tonnage of the United States, which amounted in 1889 to 619,137,237 tons.

MANUFACTURE OF PLATE GLASS AT KOKOMO, INDIANA.

BY H. C. HOVEY.

The remarkable advantages furnished by the discovery of natural gas at Kokomo, Ind., have induced numerous manufacturing companies to invest capital there, the most important of which is the Diamond Plate Glass Company, whose plant now covers eight acres. The company control twenty wells of their own, together with a large tract of gas territory. They have invested \$2,000,000, and employ from 600 to 1,000 men. The location is only a mile from the city, and the intervening space is being rapidly built up with a superior class of houses. The officers of the company at present are: A. L. Conger, president; M. Seiberling, general manager; M. P. Elliott, superintendent; F. M. Atterholt and W. L. Clause, secretaries; and E. G. Keith and A. G. Seiberling, treasurers. The list of stockholders is large, and the whole business is on a firm foundation, with a degree of prosperity such as to induce them to duplicate their Kokomo works at Elwood, a point twenty miles south. At Elwood the water supply will be from artesian wells; but at Kokomo water is drawn from the adjacent Wildcat River by a huge pump, with a capacity of 3,000,000 gallons per diem. The engine by which power is supplied for the works was built by E. P. Allis & Co., of Milwaukee, and has a capacity of 600 horse power.

The materials used are those that ordinarily enter into the composition of plate glass of fine quality, namely, white sand, ground lime, sulphate of soda, arsenic, and charcoal, mixed in special proportions. The melting pots are made of Missouri fireclay that comes prepared in barrels. Having been properly mixed, it is trodden by men barefoot until it gets the right consistency, when it is divided into small rolls, and piled up for use. One man has eighteen pots under manipulation at once, building up each by "spells" of six inches a day, and taking twelve days to finish the lot. This rather tedious process is necessary in order to allow time for the clay to harden as it is built up. No machinery has yet been devised competent to be substituted for the human hand in this important process. When it is remembered that a pot is required to hold from 1,000 to 2,500 pounds of molten glass while being handled by a dozen men, it is clear that the greatest care and thoroughness must be demanded in its manufacture. Every pot bears the initials of its maker, as well as the date of making, and all are allowed to stand for seasoning a considerable time before being used. The average life of a pot in constant use is about thirty days. Tiles and stoppers are also made in the same pottery, but of a different grade of fire-clay.

There are two large furnace rooms. One room has three furnaces, with a capacity for twenty pots each, while the other has two furnaces for sixteen pots each. By recent improvements there is a great saving of fuel, as well as a material reduction in the time required for melting, and hence a corresponding diminution of the cost of manufacture. The required heat is 3,000° Fah. The natural gas is supplied from the wells by large mains, from which service pipes go to the several furnaces. It is impossible to tell the exact amount of gas daily consumed; but an estimate has been made of about 6,000,000 cubic feet. When the glass in any pot is properly melted, the pot is run out of the furnace room on a tramway to the annealing room, lifted by a

crane, meanwhile being steadied by great tongs, and the contents emptied directly on the casting table. This is a heavy, flat table of iron, somewhat larger than the largest plate that may ever have to be cast upon it. At one end is a heavy cast iron roller, the full breadth of the table, and fitted so as to roll the entire length of the table by means of gearing along its sides. Narrow strips along the edge determine the height at which the roller runs above the table, and this again determines the thickness of any given plate of glass. An adjustable apparatus also fixes the breadth of the plate. The semi-fluid mass poured from the melting pot on the table is pushed before the roller, leaving a uniform layer between the moving surface of the latter and the casting table. The glass does not instantly solidify, hence the edges have a rounded appearance. A bar pressed against the end farthest from the oven thickens the plate for a few inches to enable its being pushed along without wrinkling. The roller having been rolled back to its carriage is trundled out of the way, the casting table is moved up to the edge of the annealing oven, whose heat has been carefully raised to a required temperature, and then by means of long iron pushers the red hot plate is shoved to its place. All this work has to be done with the greatest rapidity, and by men who may have been idle for an hour waiting for the turn of their gang.

I timed one operation as performed by a gang of fifteen. It took one minute and a quarter to run the melting pot to the casting table, and in two minutes and a half more it had been lifted, emptied, the glass rolled, the roller withdrawn, and the plate run into the oven. Total time, three minutes and three-quarters.

This was extraordinarily rapid work; the usual time allowed for each operation being about nine minutes, and the time for handling twenty pots being, on an average, three hours. The men are well paid, and seem to be vigorous and in good health. I was assured that serious accidents rarely happen, although slight injuries from the scorching heat or from the bits of broken glass are frequent.

Four plates may be laid at a time in each oven, and seventy-two plates may be cast in a day. There are forty-eight ovens in all, each measuring 25 by 40 feet in size; from which it will be seen that the annealing house must be very large, especially as ample space must also be allowed for manipulating the castings. When the plates have been in the oven for four or five days, the temperature meanwhile having been slowly reduced to that of the ordinary atmosphere, they are withdrawn. At this stage they have a rough, undulating appearance, and seem to be opaque, however pure and clear they may be in fact. They are now inspected for flaws, bubbles, blotches, and any other defects, which are marked for removal, or if necessary to be cut out. The edges are then squared by cutters and the plates go to the grinding room. The Dalish grinding tables are used, of an improved pattern, consisting in each instance of an octagonal revolving flat table of wrought iron, 25 feet in diameter, pierced by holes for pegging the plates to their place, across which extends a fixed bar carrying a pair of revolving runners (or "shoes"), that get their motion from friction with the edges of the more rapidly whirling table. These compound revolutions have the effect of grinding uniformly all the surfaces of the plates exposed to their action. This is done, first, by sharpsand, and then by carefully prepared emery, the table being constantly wet by a stream of water.

The process of fixing the plates for grinding is interesting. Twelve men carry the great plate by straps edge wise; while a thirteenth guides them along, taking notice that the plate does not tip too far one way or the other, and that its top does not strike anything. The largest plate yet made was in the works at the time of my visit, and measured 204 inches by 144 inches, weighing 2,000 pounds. Such a plate is valued at \$500, and must be handled with great care. When all was ready, the grinding table was flooded with ten gallons of plaster of Paris, which was distributed by mops. Then the glass was slowly and very carefully lowered on to the table. What followed was unique and exciting. A dozen men mounted upon the prostrate plate and executed very odd and grotesque dances in order to set the glass properly in the plaster. This is called "the plate glass jig." When the plate, or plates, that have to be ground are set, they are pegged securely by wooden pins; and then the rotary motion begins, slowly at first, but increasing to sixty revolutions a minute. Once in a while, but not very often, a plate that has been insecurely fixed flies from the wheel, to the damage of itself and whatever it may strike. There are sixteen grinding tables in all, and each runs by an independent sixty horse power engine.

Although the sand and emery are selected and prepared with the greatest care, it is out of the question to prevent occasional scratches by coarse particles that creep in. Therefore all plates on emerging from the grinding room are inspected, and every blur or scratch is marked, to be rubbed down by hand in the rubbing room. The edges are also inspected for nicks and fractures, and properly squared. The plates then go to the polishing room. The polishing material is rouge

(peroxide of iron), applied in a liquid state by weighted blocks of felt. There are twenty-eight polishing tables, so arranged with reciprocating motions that all parts of each plate are brought evenly under control of the rubbers. During these grinding and polishing operations the plate parts with about 40 per cent of its thickness as seen in the rough. After final inspection the plates are cut to the required size, packed, and shipped on cars that are run by a side track directly into the factory. Oddly enough, some of the most serious accidents have occurred during this final inspection. The plate stands on edge, with a man at each end to hold it steady, while a third does the inspecting. The men stand so far apart, on account of the great size of the plates, and the material itself is so beautifully clear, that an incautious workman or unlucky visitor imagines that nothing stands in his way, and accordingly he walks right into the glass. The result may be merely a great surprise, or it may be a fractured plate and a broken arm or abraded nose, or some other injury. In conclusion it should be added that for clearness, freedom from every kind of flaw, homogeneity of material, and luster of finish, the Kokomo plate glass equals any other American product of the sort, and compares favorably with the best results obtained by European manufacture.

Absorption of Drugs from Ointments.

BY DR. A. P. LUFF.

The author describes some experiments he has made with the object of ascertaining to what extent drugs spread upon the skin in the form of ointments are absorbed into the general circulation. The several ointments containing soluble drugs were prepared, and each ointment was placed inside a sheep's bladder; the bladder was suspended in a beaker of distilled water, kept at a uniform temperature of 98° F. in a water bath. The ointments were prepared with three different substances as a basis, viz., vaseline, lard and lanolin. The results of these experiments are thus classified: Vaseline and iodide of potassium, exsmosis commenced at end of one hour; lard and iodide of potassium, at end of nine hours; lanolin and iodide of potassium, nil at end of twenty-four hours; vaseline and carbolic acid, exsmosis commenced at end of two and three-quarter hours; lard and carbolic acid at end of seven hours; lanolin and carbolic acid, nil at end of twenty-four hours; vaseline and resorcin, exsmosis commenced at end of ten hours; lard and resorcin, at end of fifteen hours; lanolin and resorcin, nil at end of twenty-four hours. These experiments have all been performed with sheep's bladders, but the author hopes to be able to publish the results of further experiments on the living subject. The practical lesson to be learned from this paper is that if an ointment is employed with the view of its active ingredients being absorbed, then vaseline is by far the best excipient to use; but if an ointment is employed for its local effect only, absorption of its active ingredient not being desired, then lanolin is the best excipient for such an ointment.—*Jour. of Dermatology.*

Interior Finish.

The intrinsic value of mahogany for any work where nicety of detail and elegance of finish are required exceeds that of any other known wood. Cherry also finds much favor on account of its pleasing effect with some builders, but it soon grows dull and dingy. Oak, which up to a few months ago was considered the most fashionable wood, is very attractive when first finished, but experience has taught most people that it does not take long to change all this, and instead of a light, picturesque interior, one that has a dusty, damp appearance is seen, that no amount of scraping, refinishing, and varnishing will restore to its original beauty. Ash, which is apt to present a handsome appearance at first, especially when utilized for interior decoration, is more apt to present a rusty appearance than oak. The causes that are so damaging to most other woods seem to bring out the better qualities of mahogany, which grows richer with age. Of a light tone at first, it becomes deeper and more beautiful with use, and although it may cost a little more at first, yet, considering the length of time it lasts, the expense is not, comparatively, as large as other woods which cost far less money, but that do not last nearly so long. What makes the wood even more valuable is the fact that unlike cherry, ash, or oak, it is very easily cleaned, because it is impervious to dust and dirt, and while it does not show wear, it grows brighter and richer, instead of growing duller. It is pleasing to the eye, a source of beauty, and a joy as long as it is in the house.—*The Builders' Gazette.*

HIME and Noad use for waterproofing textile fabrics a solution of cotton, or other vegetable fiber, in an ammoniacal copper solution containing four parts of copper. From this solution the copper is precipitated with zinc, when a colorless viscid solution of ammonium zincate and vegetable matter is obtained, in which the tissue is immersed to impregnation, pressed, dried, and wet-calendered.