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IRON WORKS OF THE SYRACUSE MALLEABLE IRON COMPANY.

The introduction of malleable castings to take the place of drop forgings is one of the features of modern metallurgy. The adoption of this process has enabled the metallurgist to produce much more ornamental designs than could be produced by drop forging without the use of the most expensive kinds of dies.

Malleable castings combine the qualities of wrought and cast iron. As intricate designs as can be produced by the highest grades and most liquid running cast iron are here made of a metal possessing the strength, malleability, and other qualities of wrought iron.

We illustrate in the present issue the works of the Syracuse Malleable Iron Company. This is one of the great metal works of the United States. In it upward of 225 workmen are employed in conducting the various operations incidental to the production of every variety of malleable castings. A general view of the works, which cover an area of four and a half acres, is given. In the background is the foundry, in area 100 × 200 feet. In front of this is the main building, which is 60 × 235 feet. The latter is devoted to the operations of annealing, tempering, pattern making, trimming, etc. It also contains the shipping room, in which the finished castings are packed in barrels for transportation by rail or canal, the pattern vault, engine, boiler, and office. The engine is a 60 horse power straight line engine, one of the leading high speed engines of the country. The boiler is of 100 horse power, and is of the Abendroth & Root manufacture. Two large chimneys rise from the main building, which produce the draught for the annealing kilns, as their draught is entirely a natural one. The taller chimney is 150 feet high. The right hand portion of this building is divided into three stories. In the background is seen the stable in which the horses are kept, while on the banks of the canal, to the left, are three coal sheds. The longer one of these is 110 × 30 feet, the next is 60 × 30, and the one in the foreground is 40 × 60. As will be seen, the facilities for shipping the product or for receiving the raw material are unexcelled. In the back of the factory, within 200 yards of it, are the tracks of the New York Central and the West Shore Railroad, while the Erie Canal runs directly at its side. The materials received include anthracite and bituminous coal, fire sand, moulding sand, luting clay, fire bricks, etc.

The first steps of the process are executed in the foundry, which include the making of the moulds from the models, the melting of the pig iron, and the casting. The iron is melted in an open hearth furnace, constructed according to the most modern type, in which the heat is derived by direct radiation from the flame and from the furnace walls, contact with the coal impurities being entirely avoided. In this way a pure quality of casting is produced, as the metal is not contaminated with sulphur. Each furnace can melt four heats a day, disposing of four tons of iron in each heat. They are run on alternate days, every other day being devoted to cleaning. The blast is supplied by a Root force blower.

Iron containing a high percentage of combined carbon is used, as making the most perfect running metal, but with it are mixed also some of the lower numbers. All along the walls at the sides of the foundry and through its center are the moulding benches. Here the models

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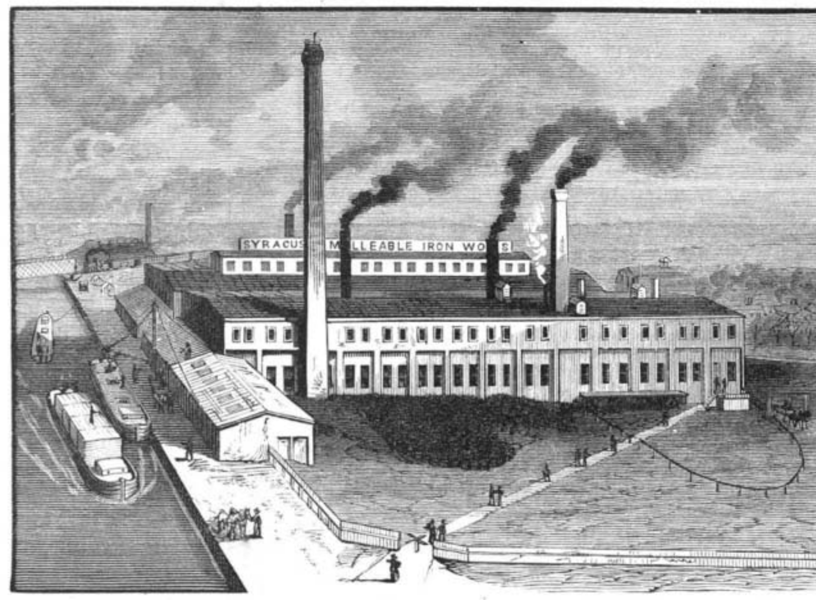
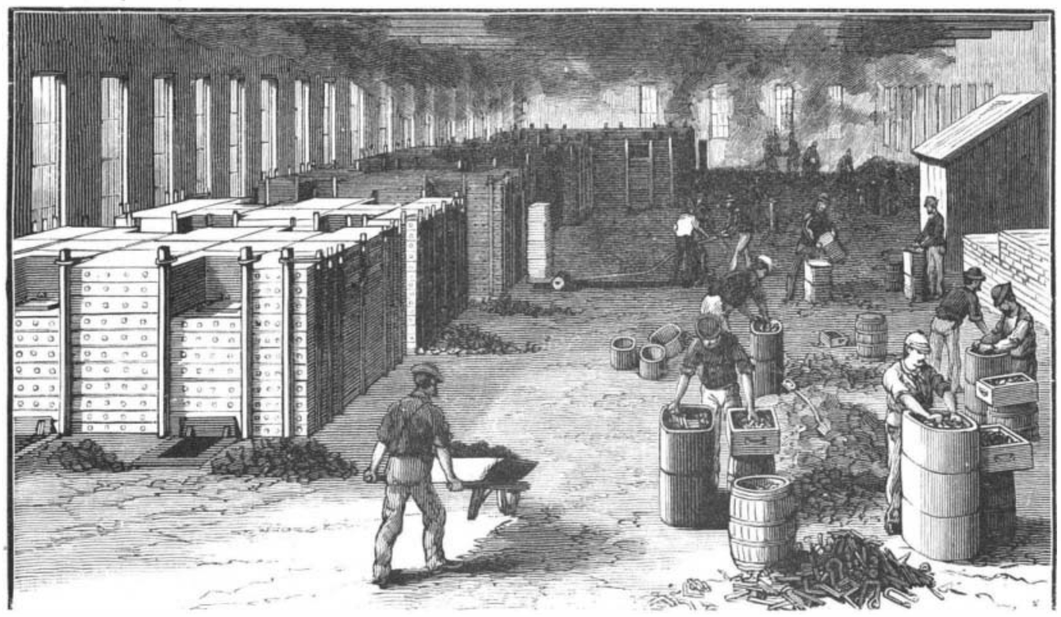
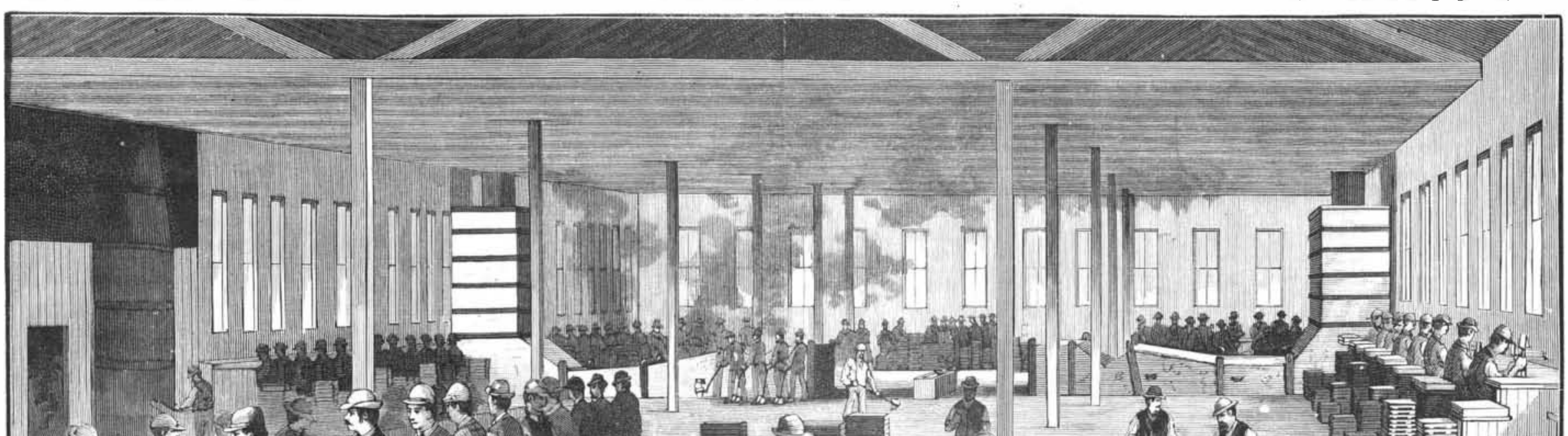


GENERAL VIEW OF THE WORKS.



THE ANNEALING KILNS.



THE FOUNDRY OF THE SYRACUSE MALLEABLE IRON WORKS.

IRON WORKS OF THE SYRACUSE MALLEABLE IRON COMPANY.

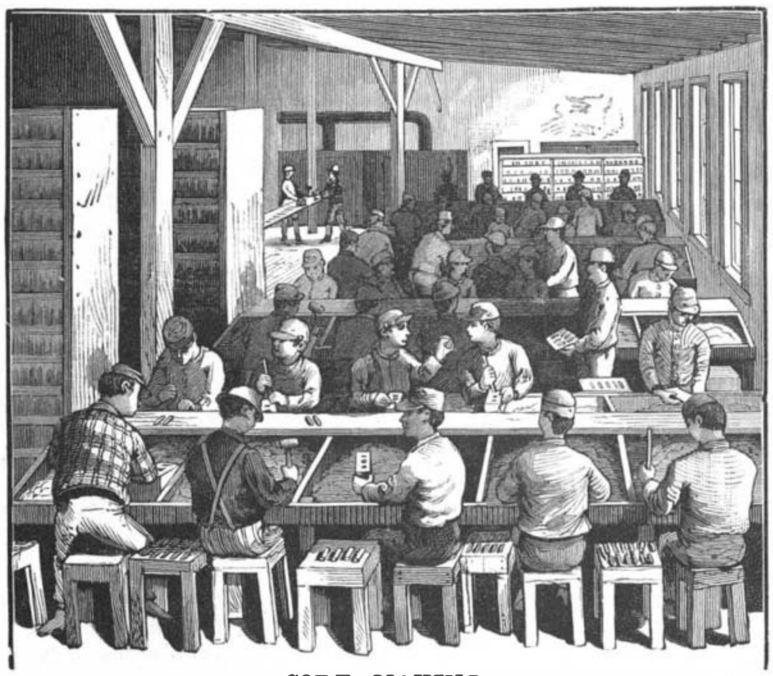
(*Continued from first page.*)

are received and are bedded in the green moulding sand which is contained in snap flasks. The latter are boxes that are secured together by detachable fastenings at the corners. The models are of a peculiar type, as they generally represent small articles. A single sheet will often contain a number of small models separated by gateways. The models are frequently made of metal and are embedded in the sand, the latter being rammed around them while contained in the snap flask. The model is removed, and the whole is then transferred to the floor where the casting is to be executed. The sides of the flask are separated, and the mould is left standing by its own consistency, the wooden bottom board, however, not being removed. This effects a great economy in flasks, but the full number of bottom boards have to be used. The moulders can be seen surrounded by piles of these boards, while on the floor the moulds with the flasks removed are standing. The furnace is tapped, and a long row of workmen with ladles stand in line to catch the metal. The ladles are made of iron, and hold from 35 to 40 pounds of melted iron. They are lined with sand, to prevent the ladles from being perforated. On an average, each ladleful can fill five flasks. The iron used, it should be observed, is charcoal pig. Before pouring the mould a cast iron weight is placed on its top, through whose center is a hole corresponding with the apertures in the mould. This holds the sand down against the hydrostatic pressure of the melted metal during the filling. Owing to the quality of the iron employed, these castings, when finished, are as hard as glass and nearly as brittle. If dropped on a stone floor or iron slab, they would break.

After cooling, the articles are removed from the moulds and taken to the annealing department. Here they have to be treated to heat in the presence of oxide of iron. The effect of this process is to gradually decrease the percentage of carbon by the oxidizing action of the cementing material, so as to ultimately reduce the brittle casting to the condition and toughness of wrought iron. If necessary, the castings are first chipped, so as to remove all fins, gates, etc., before being delivered to the annealers. By the annealers they are packed away in iron vessels called pots, and as fast as they are stored away in these, rolling mill scale is shoveled in among them, the object being to lay them in even layers without touching, so as to have each piece completely surrounded by scale. The pots are 18 × 22 inches in area and 16 inches deep. They are stacked three and four high and are luted with clay at the joints, and clay and sand are placed on top of them.

In this way pot after pot is stored full, and they are placed on top of one another to the height of four tiers. These are then taken up on a suitable truck, which is seen in the background of the cut, and are rolled into the kiln. These pots deteriorate very quickly, and part of the work of the foundry is devoted to the manufacture of the same. The iron for these, as it need not be of pure quality, is melted in a cupola furnace, which can be seen on the right hand of the foundry. The annealing kiln is filled with these pots. It can hold from 64 to 140, according to the size, averaging from 6 to 12 tons of castings for the small kilns and as high as 18 for the large. The firing then commences. For four days the pots are exposed to a red heat, and for two days the kilns are allowed to cool, then the pots are removed and their contents discharged on the floor. The castings are removed from the scale and are ready for cleaning by the tumbling process. The scale is placed to one side. In each annealing process the oxygen of the scale is, of course, exhausted. In order to regenerate it a solution of sal ammoniac is sprinkled upon it. This reoxidizes it and brings it again to the condition of peroxide. The tumbling department contains a series of cylindrical vessels which are kept rotating. These are charged with castings, and by their rotation the objects are perfectly cleaned. The tumbling process is executed dry.

A very characteristic department is the core making room. For such small objects which have to be cast in such large quantities, an enormous quantity of cores are naturally required. They are manufactured in moulds by boys, and as fast as they are dried in the kilns—which can be seen in the back of the core-making room—they are stored away in racks to one side. For every casting which includes a perforation a core is, of course, used, and this gives some clew to the immense number which are required for such an establishment.

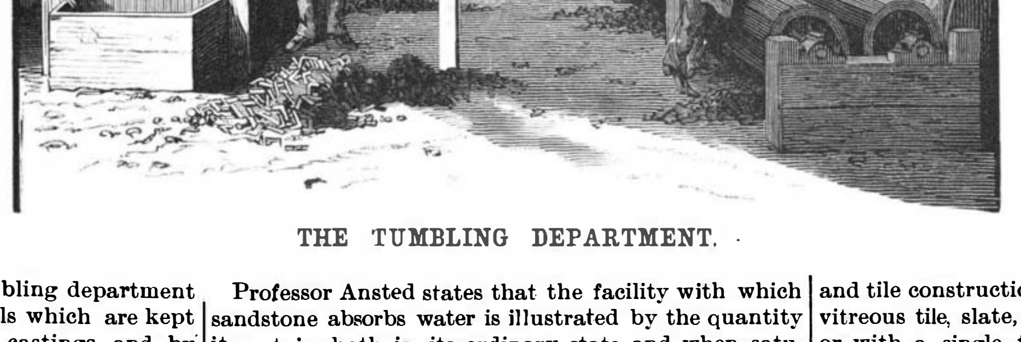


CORE MAKING.

The works were started by W. B. Burns, in 1882, and are still under his proprietorship. Mr. A. W. Dowsland is the superintendent. The work is generally skilled labor, such as pattern making, moulding, and the like.

The castings made in these works vary in weight from one-half pound to three hundred pounds. They are generally shipped in barrels, as these are more conveniently moved than square boxes. Each barrel holds from 100 to 800 pounds.

The works annually consume 3,000 tons of coal and 15,000 fire brick are used every year. Of the forge cinders but little is required each year, as they are used over and over again.



THE TUMBLING DEPARTMENT.

Washable Walls in Cottages.

E. Chadwick, in the *Architect* (London), says: As a principle, all interior cottage walls should be made washable. Besides the evil arising from absorbency of the animalized gases of walls of the common construction, there is another great source of evil attaching to walls of the common soft stone construction—the absorbency and retentiveness of water or damp. In England the common bricks absorb as much as a pint or a pound of water. Supposing the external walls of an ordinary cottage to be one brick thick, and to consist of 12,000 bricks, they will be capable of holding 1,500 gallons, or 6½ tons of water. To evaporate this amount of water would require nearly a ton of coal, well applied. The softer and more workable stones are of various degrees of absorbency, and appear to be more retentive of moisture than common brick.

Professor Ansted states that the facility with which sandstone absorbs water is illustrated by the quantity it contains both in its ordinary state and when saturated. He states that even granite always contains a certain percentage of water, and in the dry state is rarely without a pint and a half in every cubic foot. Sandstone, however, even that deemed fit for building purposes, may contain half a gallon per cubic foot, and loose sands at least two gallons. When water presents itself in any part of such material, it readily diffuses itself by the power of capillary attraction, by which, it is observed on some walls in Paris, it ascends 32 feet from the foundations. Walls of such absorbent constructions are subject to rising wet by capillary attraction, as well as to the driving wet of rain or storm. To guard against the driving wet on the coast expensive external coverings of slate are used. But these do not stay the rising wet. This wet, having to be evaporated, lowers temperature. Damp walls of houses cause rheumatism, lower strength, and expose the system to other passing causes of disease.

In London it is admitted that houses, even of the better class, cannot safely be inhabited in less than nine months. Indeed, registrars of deaths are aware that an extra death rate is, after all, usually attendant on their first occupation. The majority of bent figures in our villages are due to the infliction of rheumatism from damp.

In Paris, notwithstanding its peculiarly dry subsoil and its drier climate, the sanitary, or insanitary, evils of the common architect's constructions appear to be even greater than in London. I was assured by a Parisian builder of considerable experience that it was unsafe to occupy any new house in Paris in less than a year after its construction, and that there were houses in Paris which would never be dry "in their lives," and would always afflict their occupants.

Electrical Attraction of Quartz.

BY ALEX. HODGKINSON, M.B., B.SC.

Quartz, like most other substances, becomes electrified by friction, and also possesses the property of remaining in an electrified condition for a period varying from ten minutes to half an hour after the friction has ceased. When this medium is used as a cover for compasses, this electrical property may manifest itself in such a marked manner as to render the readings of the instrument utterly unreliable, and more especially is this the case where the instrument is provided with a quartz cover back and front. In the compass exhibited the back and front of the instrument consist of two plano-convex lenses of quartz with their plane surfaces toward each other, the needle rotating between these covers on an axis, the extremities of which fit into two conical holes in the center of the quartz covers. In the case of this instrument the mere act of removing it from the warm pocket is usually sufficient to cause the needle to assume a fixed position in relation to the compass itself, and quite unaffected by the magnetic attraction of the earth. If, while in this condition, the instrument is rotated, the needle also rotates as if a fixture. If the surface of the quartz be rubbed with the dry finger in a radial direction, the needle at once takes up a position in the same direction, and if compelled by shaking to change its position, it resumes it when allowed to remain at rest. When the compass is so turned that the axis of the needle is in the direction of the magnetic force of the earth, and the needle therefore in equilibrium, the effects of radial friction become still more marked. As might be expected, the property is not confined to quartz. A compass covered with glass exhibited the same phenomena, with the important difference that in this case the attractive influence ceased with cessation of the friction. That the attractive influence is quite independent of the magnetic force of the needle is proved by the fact that an instrument similar in every respect to the first mentioned instrument, excepting that the needle was left unmagnetized, exhibited the same phenomena. The action is thus one of simple electrical attraction.

Fireproof Building Material.

The *Real Estate Record* says that fire ruins show that porous terra cotta bricks and blocks best resist fire, water, and frost. Next to these in the order of fire resisting qualities come concretes and burned clay work. In the best work done, the iron work is incased in porous terra cotta, tile, or brick work in roof, floor, and tile construction. The hollow tiles are faced with vitreous tile, slate, or any good weatherproof coating, or with a single thickness of brick. Iron and steel framework incased in fireproof materials gives the best possible results. There is a growing preference for light porous walls of hollow material protecting an iron or wooden framework. Massive and heavy walls of brick or stone will do for architecture, but they are not as much of a mechanical necessity as they were regarded a few years ago.