



IRON WORKS.
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IRON WORKS—THEIR LOCATION, ARRANGEMENT AND CONSTRUCTION.
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By the term "iron works" we do not mean the furnaces where ore is converted into pig iron, nor the roll-

ing mills where this pig iron is deprived of its carbon and brought to the form known to us as wrought iron, but those establishments erected for the purpose of manufacturing iron into boats, buildings, engines, machinery and tools.

In the selection of a location for extensive iron works, several points are to be considered. Prominent among these is the supply of material and labor. The articles of material required in greatest quantity are coal and iron, and these can be supplied most cheaply in the

vicinity of the mines whence they are obtained. It is impracticable, however, to locate ourselves at the mines, unless these are upon some great thoroughfare or upon the seaboard, or unless we design to make a speciality of machinery demanded in mining operations.

If it is anticipated to do much work for distant points, it is indispensable to be where shipment can be readily and cheaply made. Most regions where coal and iron are found, have some leading point of shipment to which these materials can be economically transported, and

from which they can find their way to places where they are required. Such a place presents to every manufacturer peculiar advantages, and to none greater than to him whose work is of a heavy class.

A market for work produced, is of course necessary. All other things being the same, the community seek those establishments with which they can hold most ready communication, and to which they can have easy access for the repairs constantly demanded by machinery. For this reason it is not well to be too far removed from the great centers of travel. The motives which have led to the establishment of works at small towns eight and ten miles from the great points of shipment referred to, have been the lower price of land, and the cheaper rate at which *employés* could live. We think it has been the experience of most manufacturers, that more work has been lost by thus isolating themselves, than would many times over pay the interest on increased value of land. With regard to workmen, the large cities possess advantages for improvement and advancement which they too slightly appreciate, and which, if there is a disposition to make use of them, more than compensate for the increased cost of living. If a manufacturer is engaged upon some article of a staple character which is always made in the same way, he may locate his manufactory almost anywhere, and have his office and a stock of finished work where the public can easily reach them; but in works where every contract has a mass of detail to be adjusted, it is of great importance to be able to pass from office to factory, and to consult with those in immediate charge of work, without much loss of time.

The city having been decided upon, the best points within the city should be sought. If much local work is desired, we should seek the quarter of the city where manufactories are most abundant. If possible, we should locate upon a street through which a track would form a connection with the railroad lines, so that work could be loaded directly upon the cars at the shop, and coal and iron coming in car loads could be taken directly to the works. A water front is an advantage, and is almost indispensable if marine engine and boat work are sought.

A rectangular lot is best suited to the purpose, because it permits a more simple connection between the shafting of the various buildings.

The buildings required are foundry, light and heavy machine shops, smith shop, boiler shop, pattern shop, store house, office, and minor buildings, such as engine house, core shop and coal houses. We will speak of each of these separately.

The foundry may be placed in the rear of the other buildings, because there is little need of visiting it, and it has no calls to make upon the other departments in conducting its operations. There are comparatively few men at work in it, and the work is of such a character that it can be laid out for the day, and then left to the molders without much need of watching.

There should be abundant yard room close at hand to accommodate heavy and bulky flasks, which it would be inconvenient to carry a great distance. It is desirable also to make use of the yard to place large castings as soon as they are finished, and thus prevent encumbering the foundry itself. The space inside the building should be clear, so cranes may swing free and command as much floor surface as possible. This involves the construction of a roof which shall have its support entirely upon the walls. The cupolas should be outside the walls of the foundry, so as to give as much floor room as possible inside. This floor room is all-important, and other things should be so placed as not to abridge it. Cranes should be so disposed as to command nearly all parts of the floor, and so that two or three can be brought to bear upon a considerable portion of it. In using large flasks, and in making heavy castings, the work is done much better with their assistance. They must be supported from the trusses of the roof and upon a foundation below. As they are usually of large size, there is a great horizontal strain upon the trusses from the points of attachment. As this strain is to be taken up finally by the walls and is applied at the top of these, we require thick and well built walls to give us sufficient stability. To convey the strain to the walls without displacing the trusses, the tie beams should be horizontally braced throughout. In constructing the

roof, provision should be made for abundant ventilation, because at the time of casting, the smoke and gases become almost suffocating in a close room. This ventilation should be so arranged that rain will be excluded, and heat may be retained in cold weather by closing the openings. Operations of molding require light, hence windows should be numerous. As all castings are to be taken to the fitting shops to be fitted up, or are to be shipped at once, we should have ready communication between the foundry and shops, and also be able to load heavy castings directly upon the cars upon which they are to be transported. This avoids handling, and of course expense. If possible, there should be a track running through the foundry, commanded by the cranes, which would form a connection with the street track and pass also to the fitting shops. Light castings can be easily taken anywhere upon trucks, and communication with the lighter fitting shops is not of great importance. The main doorway of the foundry, through which the track enters, should be large, to enable pulleys and fly-wheels of large size to be taken through upon their side, as they are handled thus with least danger.

As there is no machinery to be driven in the foundry, we need not pay any attention to transmission of power to the building.

The operations connected with fitting up work form a leading item of the cost of machinery, and it is best so to arrange shops that these can be conducted to the best possible advantage. Of course, suitable machinery is the first requisite; but much is accomplished by having properly arranged buildings for the reception of this. The boring of cylinders and of large wheels and pulleys requires considerable vertical as well as horizontal space, and should be done, therefore, in rooms with high ceilings. Setting up large engines also requires high ceilings. For the great mass of work, however, a low ceiling is no objection, and has a decided advantage in the greater facility with which belts can be adjusted and shifted on main and counter shafting.

These considerations will naturally lead to a division of the work, the first-mentioned going to a one story building with high ceiling and the other to a two story shop, in which, for the same ground space, we double our available room.

The first-mentioned shop, which we designate as the heavy fitting shop, should contain the large boring mills, heavy planers and slotting machines. The track from the foundry should pass directly to this shop, and cranes within should be so arranged as to command the track and the principal tools. A certain portion of this should be appropriated for the setting up of large work. A large beam engine cannot be set up without a high ceiling, and yet should not be sent out until it has been put together and adjusted. This part of the floor should have a crane at its service.

The other building, which is the principal machine shop, will contain all the lathes together with planers, drills, bolt and gear-cutting machines, and the numerous other tools required in fitting. Here also the great mass of vice work is done.

The light iron work, and usually all the brass work, is done in the second story, while the first story is reserved for turning heavy shafts, and other work in which the assistance of cranes is required. This building does not require immediate connection with the foundry, because castings worked are not so heavy as to be awkward to handle. It should be so placed, however, as to make loading upon cars or upon wagons in the street an easy operation.

The smith shop must be in close proximity to the machine shops, because to them goes the great bulk of its work, and because the machinists require the frequent assistance of the blacksmiths in making and altering tools. Communication should be so easy that little time need be wasted in going and coming. The building should be long, and made with a roof which will permit the free exit of smoke. The size depends upon the number of forges needed. Arrangements should be made so as to bring a line of shafting through the shop to drive fans and hammers. Yard room near the smith shop is an advantage.

The boiler shop must be roomy rather than substantial. It must be so located that power can be taken to it to drive punches, shears and rolls; and it should be as far from the other shops as possible.

shall be heard as little as may be. It should have free opening into the yard, and be provided with a very large doorway. Machinery should not be located so as to interfere with the turning and handling of bulky boilers.

The pattern shop may be of two stories, and should be convenient to the office and foundry. It requires power. The store house, for patterns and finished work, may be combined with the pattern shop. The second story answers for the stock of patterns, and the first one for the storage and display of finished machinery and for packing. This should also be convenient to the office.

The office should occupy a building distinct from all the others for evident reasons. In it the books, papers and drawings of the establishment are preserved, and they are in less danger in case of fire than if in one of the shops. Again, the transaction of business is facilitated by quiet, and this is best obtained by a building a little removed from all the shops, and as far distant as possible from the smith and boiler shops. Further, the drafting should be done near the office, and the second story of the office building affords the very best position for it. Drafting requires light and freedom from jar and dust. These can be obtained nowhere so readily as in the second story of a substantial isolated building, where we have windows on all sides.

It is essential, in locating engines, to have them near their heaviest work, and so placed that power can be transmitted from them in all directions with the least possible expense of shafting. It is difficult, in extended works, to make one engine do all the work. It is generally necessary to divide it, and place two or three engines at points where they are most needed.

The boilers should be placed in buildings entirely independent of the main ones. Experience has shown that in explosions the large buildings suffer comparatively little if the boilers are somewhat removed from them.

One building adjoining the foundry may be made to answer the purposes of the core makers and cupolas. It should have ready communication with the foundry.

Places under cover should be provided for coal at various points near to where it is required.

Heating the buildings should be done by steam if possible.

In the plans which accompany this the foregoing arrangement has been sought. The description of the above will be published next week.

GREAT GRAIN ELEVATOR.—A vast grain store with an elevator has just been completed at Buffalo, N. Y. The height of the edifice, from foundation to peak, is 89 feet; its length is 180 feet, and its breadth, 134 feet. It is built adjoining the freight depot of the New York Central Railroad, and is so connected with it that a stream of grain may be poured into the railroad cars bound for the east, from vessels that have just arrived from the great West. The building and machinery were planned by S. H. Fields, Esq. One floor can contain no less than 553,600 bushels, held in 172 bins; the machinery is capable of elevating 4,000 bushels per hour.

GIVE THE PRICES OF ADVERTISED ARTICLES.—A Sandwich Island correspondent, in forwarding to us a fine club of new subscribers, makes the following suggestion:—"The advertisers of new articles would find it to their interest to state the price. It would be a great help to your foreign subscribers, like myself. I have seen a great many things which I should like, but have declined to order, not knowing what they might cost."

WISCONSIN STATE FAIR.—The Tenth Annual Exhibition of the Wisconsin State Agricultural Society promises to be the finest ever held in the State. The grounds, situated within the limits of the city of Madison, and directly on the Mil. & Miss. R. R., are said to be unsurpassed, for natural beauty, by any in the United States. We observe that Wiard's famous ice-boat is to be on exhibition, with its machinery in full operation. It commences on the 24th of this month.

HOWE'S SEWING MACHINE PATENT was extended on Saturday last by the Commissioner of Patents, for seven years. The value of this extension to the patentee is variously estimated at from \$500,000 to \$700,000 for the whole term. A rich place, indeed!