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MALLEABLE IRON AND STEEL FROM PIG IRON.

What is called the "Bessemer process" for converting pig iron into steel and malleable iron is generally understood to consist in forcing currents of air through molten pig metal as it is run off from a smelting or a cupola furnace. By this process it is held that the oxygen of the air-blast combines with a portion of the carbon which exists in excess in the pig iron, removing it in the form of carbonic acid gas. The extraction of a small quantity of carbon from the crude metal still leaves sufficient to form steel, which is a compound of iron and carbon; the removal of a larger portion of carbon reduces the metal to malleable iron. Immediately after this process had been prominently brought before the public, some years ago, it was noticed that while good steel was produced at one smelting, very inferior steel sometimes resulted at the next smelting, although the operations had been conducted in precisely the same manner. So much uncertainty was felt respecting the quality of steel and iron thus produced, that the process was held to be impracticable in its application on a large scale. But Mr. Bessemer devoted himself to the subject of investigating the causes of uncertainty in securing uniform results, and at last he worked out the problem, for his process is now practiced in England, Sweden, Germany and France, and also used in the works of Corning Winslow & Co., near Troy, N. Y. Thousands of tuns of steel are made annually by it in Europe and its use is rapidly extending. It was found by Mr. Bessemer that different qualities of pig iron gave different results, and that workable steel could not be produced by the mere passing of air through all kinds of molten pig metal. It was observed that although the excess of carbon was removed by the blast, other impurities, such as phosphorus and sulphur that are common to inferior crude metal, remained. The next course was to experiment with the best pig iron, the quality of which was known to be uniform. With Swedish charcoal pig-iron uniform success attended every effort, and similar grades of steel were produced at every smelting. Thus, in a general sense, the process was perfected for practical application. With the best brands of Swedish pig iron good qualities of cast steel and bar iron for forging are now asserted to be made by this process. The loss of weight in the material in converting the crude iron into steel is from 12 to 15 per cent; in converting it into bar iron, from 18 to 22 per cent. A tun of molten pig iron may be converted into steel in seven minutes—the pressure of the blast used ranges from seven to twenty pounds on the inch, according to the quantity of metal smelted. About 1,200 cubic feet of air is required for refining a tun of metal, and a better result is obtained with this than a smaller quantity. It is indispensable to the production of good steel and bar iron, by this system, that the best qualities of pig iron be used; yet coarse steel, called "semi-steel," and common malleable iron may be made from inferior pig iron, by using a small quantity of manganese and Franklinite pig iron mixed with it.

As it is now better understood, this peculiar refining process commends itself to many of our iron manufacturers. By a simple and not very expensive arrangement of apparatus and mechanism they may produce medium cast steel and bar iron from pig iron at a small cost compared with the tedious modes now practiced, consisting of several re-heatings involving a great expenditure for fuel and mechanical labor. The magnetic iron ores are abundant in Maine, New Hampshire, Massachusetts, New York, New Jersey and other States, and from these, when smelted with charcoal, pig iron can be obtained, similar in every particular to the Swedish brands. Our natural supplies of this ore are inexhaustible, and with anthracite coal it may yield superior pig metal, as that fuel does not contain sulphur like the coke made from bituminous coal. This is a subject of vast importance. Iron is now superseding wood in every department of engineering and mechanism, and every effort should be made to improve its quality and reduce its cost. The demand for it seems to increase faster than the supply. In house-building, bridge-building and ship-building it is fast becoming the leading material, and there can be no question of the fact that, with an abundant supply of cheap steel, all the useful arts will be benefited and advanced.

A PNEUMATIC POST.

The instantaneous connection of remote points by mechanical means has become one of the necessities of the age. The stage-coach has had its day and it has been superseded by the locomotive, and even the business communication between cities, at one time easily transacted through the mails, has been vastly aided by the introduction of the telegraph. This latter medium is available for messages only, and if we desire to transport material we must, in the present state of things, have recourse to the rails again. Science provides a remedy for the matter in the adoption of the pneumatic post; and packages, propelled by atmospheric pressure, are now safely and swiftly transported from point to point in England. The question arises how far these lines are capable of practical development, and what degree of economy exists between the substitution of air as a propelling agent for the power of steam? These questions we cannot answer decisively, but they can be readily solved by experiment. The principle of the pneumatic post consists in applying the weight of the atmosphere to a sliding or rolling object in an exhausted tube; and it was formerly supposed, in the earlier experiments on this subject, that the degree of mechanical accuracy which was necessary to the perfect working of so subtle an agent as common air, would materially interfere with the utility of the scheme. It has been found, however, on the English lines at least, that mathematical accuracy was wholly unnecessary and that the inherent difficulties were over-estimated. It must be borne in mind, however, that the English line of pneumatic post is quite short and is worked at what we consider a low rate of speed, that is, from 20 to 30 miles an hour; we do not state this positively, but we have been so informed. At such speeds there can be but little advantage derived over the ordinary means of communication, since the express trains, running at 40 and 45 miles an hour, would outstrip the pneumatic post. The only way in which a line of this kind could be rendered superior to the ordinary methods of transportation would be in having the speed of the package transmitted under control, so that greater or less rapidity could be given to it, as desired. Where the working pressure is a fixed quantity, as in the case of an exhausted tube, it is manifest that the means of regulating the velocity of the goods forwarded must be very uncertain. If, however, we modify the apparatus, so that instead of depending on the simple pressure of the atmosphere against an object *in vacuo*, we not only obtain a vacuum but also condense the air behind the package to be driven through the vacuum, we shall have a force limited only by the extent to which the air is condensed, minus the difficulties existing in the tube and car. These difficulties will be apparent to all who have ever given attention to the subject.

An apparatus on this principle has been already experimented with. We recently saw a short line at Carhart and Needham's extensive melodeon manufactory in Twenty-third street, this city; and no serious objections were apparent to us in the general plans of the inventor, Mr. Needham. The idea (we are at liberty to make it public) is simply an endless tube having relays of exhausters, most suitable for the object in view, at various intervals. The car containing the package is placed in the tube, and the exhausting apparatus set in motion. The package constitutes a diaphragm or partition in the tube, and the air is removed from before it and delivered behind it by the same machine. This is simply the idea and it worked well in the imperfect wooden model which we have mentioned. The proper means were pointed out to us for checking the package car at the station, and for removing the contents at any station almost instantaneously. This scheme is perfectly feasible and one that should be tried on a larger scale. Operated almost entirely under ground, the pneumatic post is open to none of the objections which apply to express companies generally, and there need be none of those expensive and cumbrous vehicles which are used by companies of the kind last-mentioned. English enterprise and energy have outstripped us in this respect, and there is at present a line of pneumatic post at work in London. Steps ought to be taken in this matter and the subject looked at in all its bearings at once, so that if there are as many advantages to be derived from it as there would seem to be, the people should have the benefit of them.

INTELLECTUAL TOOLS.

It is a matter of very great surprise and regret to us to hear, as we have heard, mechanics exclaim when recommended to take this or that mechanical work—"Oh! I don't want that," or "I guess I can't afford it now," and kindred objections mistimed and ill-applied. These men were not, as many would suppose from their exclamations, ignorant; on the contrary, they eagerly sought all means of obtaining practical knowledge of their professions and were emulous of the first position as artisans. If their tool-chests were examined the result would disclose a complete assortment of the most improved instruments in use, and a great many others not generally known, that the ingenious makers had contrived for special needs and ends. When the hours of labor were transpiring, the men of whom we speak were diligent at their duty, but when their work was done those men lost sight of every thing and let the "shop" go until the next day. A proper relaxation of the mental powers is just as necessary to perfect health as rest to the over-taxed body, but an utter neglect of mental culture brings its own punishment with it.

It is impossible for any workman to keep up with the spirit of the age unless he consults such works as are published for his special benefit. If he ignores utterly and wholly the discoveries of men of science at home and abroad, he alone will be the loser by it. A mechanic may be very skillful, intelligent and apt at his calling, but he does not combine all the mental energy of the period, and however enterprising he may be, there are others, his equals and superiors, who might benefit him if he would only lend an ear to their teachings.

There are undoubtedly many seasons in the life of an artisan, as there are occasions in the personal history of every individual, when he feels straightened in his circumstances and unable to afford the small sum necessary to purchase intellectual aliment. But if we look upon these papers, books, or whatever form the knowledge is issued in, as *tools*, we must admit the justice of purchasing them at some sacrifice of needless gratification. On the one hand we see a mechanic furnishing his mechanical *repertoire* with all modern appliances wherewith to prosecute his business successfully, but on his intellectual needs he expends not a cent. We have all read the fable of the hare and the tortoise; how the former challenged the latter to a race, and, confident of his ability to outstrip his toiling antagonist, set out in the morning, ran awhile, then sat down and slept. While he slept the tortoise, slowly but certainly, devoured the way and reached his goal just as the hare came panting up too late. The brilliant but unlettered mechanic is the hare who runs his race in the heyday of his powers, while the less gifted individual, who depends not alone on the work of his hands, but unites brain with muscular exercise, achieves his end not less quickly and much more certainly, than he who relies blindly on mere dexterity. It is only by a proper union of intellectual cultivation with man-