NEW MODE OF MANUFACTURING IRON AND STEEL.

The new and extremely ingenious process just patented by Mr. H. Bessemer, of manufacturing malleable iron and steel without fuel, and recently propounded by him at the meeting of the British Association for the advancement of Science, in a paper replete with interest, has just been put to a severe practical test, but with the most successful result, at Baxter-house, St. Pancras road, in the occupation of that gentleman and his partner Mr. Longsdon, in the presence of several iron-masters carrying on an extensive business in different parts of the country, and many practical engineers and scientific men resident in the metropolis.

The magnitude and importance of this discovery of Mr. Bessemer can scarcely be exaggerated. The only parallel to it is to be found in the kindred invention of Henry Cort, which, towards the close of the last century, relieved this country to a great extent from its commercial servitude to Russia and Sweden in regard to its supply of wrought iron. Two years have been spent by Mr. Bessemer in the perfection of his scheme; and when, the other day, he divulged it to the world before men distinguished for their scientific attainments, and practical manufacturers well able to appreciate its vast public significance and its whole bearing on the trade in which they are interested, it took them wholly by surprise, superseding as it does, the expensive, laborious, and tedious process now in use in the production, and the application in some cases, of malleable iron and steel in this and many other countries, cheapening those articles to an extent which will lead to their employment, and especially steel, for purposes to which they have never yet been subservient, and in many respects refining and improving the quality of the metal. Men like the two Rennies, Nasmyth, and others of minor note, but of great experience as engineers and iron manufacturers, have pronounced emphatically and without qualification in its favour, while some, including Nasmyth, declare themselves unable to foresee the whole of the advantageous results calculated to spring from its discovery; not to this country alone, but wherever else it may be brought to use,

The essential feature of Mr. Bessemer's invention is, that he takes crude iron directly from the ordinary blast furnaces, and in the incredibly short space of thirty minutes converts it into ingots of malleable iron or steel of any size, and fit for the various manipulations ordinarily employed to adapt them to all the material purposes to which they are now applied. He thus dispenses with all the intermediate processes to which recourse has been had to produce the same effect within the last 70 years, including the making iron into pigs, and the refining, puddling, and squeezing stages, with all their attendant labour and fuel. Paradoxical as it may seem, it is not the less true, that he has achieved this great result by the application to the iron, in its transition from the blast furnace to the condition of the ingot, of a heat inconceivably intense, generated without furnace or fuel, and simply by blasts of cold air. By this means he not only avoids the injurious action of mineral fuel on the iron under operation, which has always detorioriated the quality of English iron, but saves the expense of the fuel. He sets out with the assumption, that crude iron contains about 5 per cent of carbon; that carbon cannot exist at a white heat in the presence of oxygen without uniting therewith and producing combustion; that such combustion would proceed with a rapidity dependent on the amount of surface of carbon exposed; and, lastly, that the temperature which the metal would acquire would be also dependent on the rapidity with which the oxygen and carbon were made to combine, and consequently that it was only necessary to bring the oxygen and carbon together in such a manner that a vast surface should be exposed to their mutual action, in order to produce a temperature hitherto unattainable in our largest furnaces. With a view of testing practically this theory, he has constructed a cylindrical vessel of three feet in diameter and five feet in height, somewhat like an ordinary cupola furnace, the interior which is lined with fire bricks, and at about two inches from the bottom of it he inserted five tuyere pipes, the nozzles of which are formed of well burnt fire clay, the orifice of each tuyere being about three-eighths of an inch in diameter. At one side of the vessel, about half-way up from the bottom, there is a hole made for running in the crude metal, and on the opposife side there is a tap-hole stopped with loam, by which the iron is run out at the end of the process. A vessel is placed so near to the discharge hole of the blast furnace as to allow the iron to flow along a gutter into it, and a small blast cylinder is used capable of compressing air to about 8lbs. or 10lbs. to the square inch. A communication having been made between it and the tuyeres, the converting vessel is in a condition to commence work. The blast being turned on, and the fluid iron run into the vessel, a rapid boiling up of the metal is heard going on within the vessel, the metal being tossed violently about and dashed from side to side, shaking the vessel by the force with which it moves from the throat of the converting vessel. This continues for about fifteen or twenty minutes, during which the oxygen in the atmospheric air combines with the carbon contained in the iron, producing carbonic acid gas, and at the same time evolving a powerful heat. The rapid union of carbon and oxygen adds still further to the temperature of the metal, while the diminished quantity of carbon present allows a part of the oxygen to combine with the iron, which undergoes combustion and is converted into an oxide. At the excessive temperature that the metal has now acquired, the oxide, as soon as formed, undergoes fusion, and forms a powerful solvent of those earthly bases that are associated with the iron.—The violent ebullition going on mixes most intimately the scoria and metal, every part of which is thus brought in contact with the fluid oxide, which washes and cleanses the metal most thoroughly from the silica and other earthly bases that are combined with the crude iron, while the sulphur and other volatile matters which cling so tenaciously to iron at ordinary temperatures are driven off, the sulphur combining with the oxygen and forming sulphurous acid gas.

In conducting the demonstration, 6 cwt. 3qrs. 13lb. molten iron from a furnace was poured into the fire-brick vessel, already described, at 12 minutes past 1 o'clock, the blast having been applied at a pressure of about 8 lbs per square inch, and continued until 27 minutes past 1. The mass of metal began to boil up, and the cinders and other impurities were extruded from the top of the vessel by two apertures provided for the purpose. Showers of brilliant sparks were thrown off during this process, which lasted several minutes; and as the object was to produce a mass of cast steel, rather than continue the process to the extent necessary for making pure iron free from carbon, the vessel was tapped at 36 minutes past 1 and the contents drawn off. Small specimen ingots being first taken, the general mass was run into an ingeniously contrived mould concealed in the floor in front of the apparatus, and after remaining there for a few minutes, cooling down, it was raised out of the mould in a red-hot state by an hydraulic ram, and placed upon a weighing machine. The ingot thus produced, with the two specimen ingots, weighed 6 cwt. Without the aid of fuel this mass of material was converted in 24 minutes from crude cast iron as it comes from the blast furnace into steel of fine quality.

The experiment was unanimously pronounced by the company to be perfectly satisfactory. It is a peculiar and important feature in the proces that by continuing the boiling for a few minutes longer the whole of the carbon still remaining in the mass of metal, and which gives to it the character known as steel, would have been drawn off, and a pure spongy mass of crystalline iron would have been the result.

Mr. Bessemer states, that hitherto the finest qualities of iron have always been imported from Sweden and Russia, and these are now sold in this country from £20 to £30 a ton; but by the new process, iron can be manufactured of equal quality at a cost of 2£ per ton less than the present cost of common English iron. If this statement be borne out by experience of this invention we shall no longer be dependent on the foreign market for the production of iron of the finest quality. He also speaks with something like enthusiasm of the extent to which what he calls semi-steel, of a quality between malleable iron and steel in ordinary use, as manufactured under his patent, may be expected to supersede in time the use of malleable iron for railway plates and many other purposes to which the latter is not altogether adapted; and he as confidently asserts, that the process of forging and welding, which, under the existing system, is necessary whenever a piece of iron-work of a larger size than from 80lb. to 100lb. is required to be constructed, will be dispensed with. He looks, also, to the universal use of his discovery, seeing that atmospheric air is the prime element used in producing the desired result; it is not, therefore, dependent upon any local circumstances.—*London Times.*

WHAT A POOR FARMER CANNOT AFFORD.

BY HORACE GREELY.

The truth I am most anxious to impress, is that no *poor* man can afford to be a poor farmer. When I have recommended agricultural improvements, I have often been told; 'this expensive farming will do well enough for rich people, but we who are in moderate circumstances can't afford it.' Now, it is not ornamental farming that I recommend, but profitable farming. It is true, that the amount of a man's capital must fix the limit of his business, in agriculture, as in everything else. But however poor you may be, you can afford to cultivate land well, if you can afford to cultivate it at all.

No poor man can afford to cultivate his land, in such a manner as will cause it to deteriorate in value. *Good* farming improves the value of land, and the farmer who manages his farm, so as to get the largest crop it is capable of yielding, increases its value every year.

No farmer can afford to produce weeds. They grow, to be sure, without cultivation; they spring up spontaneously on all land, and especially rich land, but though they cost no toil, a farmer cannot afford to raise them. The same elements that feed them, would, with proper cultivation, nourish a crop, and no farmer can afford to expend on weeds, the natural wealth which was bestowed by Providence to fill his granaries. I am accustomed, my friends, to estimate the Christianity of the localities through which I pass, by the absence of weeds on and about the farms. When I see a farm covered by a gigantic growth of weeds, I take it for granted, that the owner is a heathen, a heretic, or an infidel—a Christian he cannot be, or he would not allow the heritage which God gave him to dress and keep, to be deformed and profaned.

No farmer can afford to sell his ashes. Depend upon it, there is nobody in the world to whom these are worth so much as to yourselves. You can't afford to sell them, but a farmer can well afford to buy ashes at a higher price than is paid by anybody that does not wish to use them as fertilizers of the soil. Situated as the farmers of this country are in the neighborhood of a city that burns large quantities of wood for fuel, you should make it a part of your system of farming to secure all the ashes it produces. When your teams go to town with loads of wood, it would cost comparatively little to bring back loads of ashes and other fertilizers that would improve the productiveness of your farms.

No poor farm can afford to keep fruit trees that do not bear good fruit. Good fruit is always valuable, and should be raised by the farmer, not only for market, but for large consumption in his own family. As more enlightened views of diet prevail, fruit is destined to supplant the expensive quantities of animal food that are consumed in this country. This change will produce better health, greater vigor of body, activity of mind, and elastisity of spirits, and I cannot doubt, that the time will come when farmers, instead of putting down the large quantities of meat they do at present, will give their attention in autumn to the preservation of large quantities of excellent fruit for consumption, as a regular article of diet, the early part of the following summer. Fruit will not then appear on the table as it does now, only as dessert after dinner, but will come with every meal, and be reckoned a substantial aliment.

HOW COAL WAS MADE.

Geology has proved that, at one period, there existed an enormously abundant land vegetation, the ruins or rubbish of which, carried into seas, and there sunk to the bottom, and afterwards covered over by sand and mud beds, became the substance which we now recognize as coal. This was a natural transaction of vast consequence to us, seeing how much utility we find in coal, both for warming our dwellings and for various manufactures, as well as the production of steam, by which so great a mechanical power is generated. It may naturally excite surprise, that the vegetable remains should have so completely changed their apparent character, and become black. But this can be explained by chemistry; and part of the marvel becomes clear to the simplest understanding, when we recall the familiar fact that damp hay thrown closely into a heap, gives out heat, and becomes of a dark color.

When a vegetable mass is excluded from the air, and subjected to great pressure, a bituminous fermentation is produced, and the result is the mineral coal—which is of various charaters, according as the mass has been originally intermingled with sand, clay, or other earthly impurities. On account of the change effected by mineralization, it is difficult to detect in coal the traces of a vegetable structure; but these can be made clear in all, except the highly bituminous caking coal, by cutting or polishing it down into thin, transparent slices, when the microscope shews the fibres and cells very plainly.

From distinct isolated specimens found in the sand stones amidst the coal beds, we discover the nature of this era. They are almost all of a simple cellular structure, and such as exist with us in small forms, (horse tails, club mosses and fens,) but advanced to an enormous magnitude.—The species are all long since extinct. The vegetation generally is such as now grows in clusters of tropical islands; but it must have been the result of a high temperature obtained otherwise than that of the tropical regions now is, for the coal strata are now found in the temperate aud even the polar regions.

The conclusion, therefore, to which most geologists have arrived is that the earth, originally an incandescent or highly heated mass, gradually cooled down, until, in the carboniferous period, it fostered a growth of terrestrial vegetation all over its surface, to which the existing jungles of the tropics are mere barrenness, in comparison. The high and uniform temperature, combined with a greater proportion of carbonic acid gas in the manufacture, could not only sustain gigantic and prolific vegetation, but would also create dense vapours, showers and rain; and these again, gigantic rivers, periodical inundations, and deltas. Thus, all the conditions, for extensive deposits of wood in estuaries, would arise from this high temperature; and every circumstance connected with the coal measures points to such conditions.

VENTILATING HAY-STACKS.—The British farmers have a method of ventilating their hay, oat, and barley stacks, which we may frequently adopt with advantage; and in stacking corn-stalks it would be always beneficial. They fill a large bag, say three and a half feet high and twenty inches in diameter, with straw, and place it vertically in the centre of the stack, putting the barley, oats, or hay, whichever it may happen to be, around it. As the stack rises they lift the slack, and so on to the top. In this way, there is a chimney formed in the centre of the rick or bay, into which the steam or gases generated find their way and escape readily.

WANTING CHANGE.—Rest is a very fine medicine. Let your stomach rest, ye dyspeptics. Let your brain rest, ye wearied and worried men of business. Rest your limbs, ye children of toil. You can't! Cut off all superfluities of appetite and fashion, and see if you can't.