their children and our own. What geologist will hence­forth call in question the abundance of that supply, which now seems to augment with the very means that are in­vented for increasing its consumption ?

The Welsh coal-field is perhaps the richest in the world. Rich with bitumen on one sidc, it gradually falls off by insensible gradations into a more purely carbonaceous, but still free-burning coal, and, passing through every interme­diate gradation, is found at last in the state of a rich, resplendent refractory anthractous, or stony coal. This, mixed in the proportion of two to three, three to two, or half and half, smelts iron readily under he hot blast, and produces a rich powerful pig, possessing the quali­ties of a rich charcoal iron, and also capable of being con­verted into a most tenacious and malleable bar iron. In the anthracite district of Wales, new furnaces are rapid­ly rising into use ; and Mr. Crane is distinguished by his ex­tensive use of Mr. Neilson’s hot-blast in that application of it

But it is probably in America that the hot-blast system will most extensively contribute to the development of mineral wealth. The anthracite is there the staple of fuel. It covers a vast extent of country, and constitutes the only substitute with which our transatlantic brethren can replace those forests that are so rapidly receding before the advances of civilization. Here the hot-blast is most successfully employed.

We have thus given out readers the general specifica­tion of the hot-blast improvement ; a specification so general as to include all possible forms of apparatus, applicable, not only to the smelting of iron, but to all cases of manufacture in which a blast is employed to produce beat, and which touches only the process of heating the air, without regard either to the mode of producing the blast, the mode of ap­plying the blast, or the means of beating air ; and the pa­tent only provides for the carrying into effect the process of heating the air, that the blast shall be passed through a heated vessel or receptacle of any form or dimensions, euch as a cast or malleable iron retort, kept to a dull red beat of some 1000° of temperature as the most desirable. It will readily be imagined that this apparatus, described is terms of so great generality, would assume various forms, according to the different views which the various practical men em­ployed to construct the apparatus took of the most effective mode of heating the air. This is accordingly what occurred with the progress of time, and the increasing experience of those who used the apparatus; practical difficulties gradually diminished with the increased experience which was every day suggesting new and better expedients. It was also soon found that the advantage gained was increased in a rapid proportion with the degree of heat communicated to the air, so that the apparatus which gave at first some 300° of tem­perature to the air, and produced one measure of benefit, was soon superseded by a second form of apparatus giving 400°, and conferring still higher advantages ; and this in its turn gave way to another and another, each giving a higher temperature to the air, and promising a higher degree of eco­nomy to the user. And thus at last a temperature between 600º and 700º was given to the air; a temperature higher than that of melting lead, which is indeed the criterion now generally applied to test the working heat of the blast.

Wτe shall probably give our readers the clearest views of these general improvements, and of the progress which has generally taken place in carrying them into effect, by taking **a** single example. For this purpose we have selected the various modes of heating the air that have necessarily sug­gested themselves to, or been put in practice by the ingeni­ous proprietors of the Butterly iron works in Derbyshire, who were the first to introduce the hot-blast into that part of the country, and who have been among the most success­ful in carrying it into effect, and producing one of the most superior qualities of hot-blast iron.

Elate CCCCLXII. fig. 1, shows the construction of the earliest and simplest plan by which the inventous of hot-blast first brought it into use. An iron vessel *h* *h h* was formed of malleable plates, rivetted together like a common steam- boiler, something near three feet in diameter, and eight or ten feet long, cylindrical, and fitted at the ends to two pipes B*b*, communicating with the bellows, and S*s* with the smelting furnace. Below this large pipe or tube a fire is placed, which is fed from the door D, and the whole is enclosed in an oven of brickwork OO OO, leaving a clear space all round the pipe *h h h,* so that the flame and hot air rising up and enve­loping the receptacle, should keep it so hot as to communi­cate through the sides of the vessel a higher temperature to the air rushing through it, on its way from the bellows, B, towards the smelting furnace S. And in order to communi­cate this temperature more uniformly and completely to all the air passing through the vessel *h h h,* lunular partitions *ppp* proceeding alternately from opposite sides of the tube on its interior surface, cause the stream of air to impinge first on one side, and then on the other side of the heated iron pipe, as shown in the figure. By this apparatus a mo­derate current of air has been heated to three or four hun­dred degrees.

Fig. 2 shows the manner in which the method of beat­ing the air was employed at first in the Butterly iron­works. In the oven Ο O are placed the two cast-iron retorts *hh,* about thirty-two inches in diameter, and nine feet long, being of metal an inch and an eighth part in thick­ness. They are laid parallel to each other ; one of them is at one end connected with the pipe B *b* from the blowing apparatus, and this conducts the air from its other extremity through a curved junction pipe J J, into the second recep­tacle *h h ;* where, on its way becoming hot, it passes through the hot-air pipe S*s,* from the heating furnace or oven, and is blown by the orifice T through the twyre T into the hearth of the smelting furnace at F. In this, as is usual, more than one blast, as at T', was blown into the same smelting furnace. The fire *dd,* is placed at one corner of the oven on the bars *rr,* and is fed from the door D, and the smoke and flame rising up and surrounding *h1h*1, pass through a partition by the flue *f,* and fill the second compartment of the oven, clear spaces being left quite round the retorts on every side for the communication of the heat ; only at the points *k* and *k,* they are supported by contact on the brick pillars *kk.* Finally, the products of combustion pass through a flue *f* into the short chimney C. In this way the cold air from the blast pipe B*b* passing into the vessel *h2 h1,* is partially heated, and is conducted into a second chamber, which, being placed immediately over the fire, is much more intensely hot, and from this second chamber at once discharged into the smelt­ing furnace.

This apparatus was first tried in November 1830. The air was only heated to 240°. Yet so admirable is the pro­cess, that it was attended with the following effect: With cold blast there were previously used at Butterly,

51/2 tons coal (coked),

to 1 ton of iron.

By the new apparatus there were required

only 3 tons coal (raw), to 1 ton of iron.

So admirable an effect as this was not to be neglected on account of the practical difficulties attending it, which indeed only served as an inducement to further exertion; and in about a year after the following improved apparatus, with an increased number of tubular vessels, having increased dimensions of length, was successfully introduced.

Fig. 3. In the transverse section *hl h2 h3,* are three pipes of east-iron l1/2 inch thick, being about 17 feet long, and about 22 inches in diameter. They are similarly de­noted in the ground plan, and in the longitudinal section by the letters *h1 h2 h3.* The cold air pipe from tin blow­ing apparatus B, enters the heating oven at *b* and traverses the pipe *h1* *h1* to the opposite end of the furnace : here a