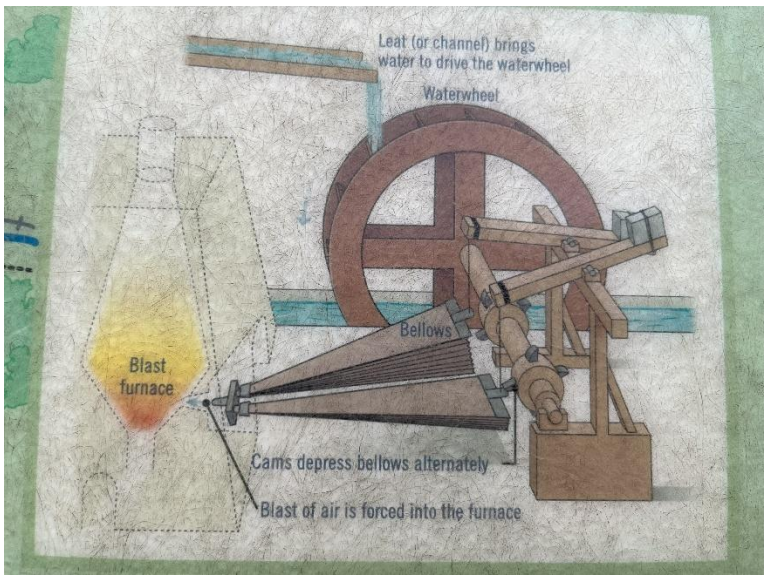
Backbarrow Ironworks - The Blast

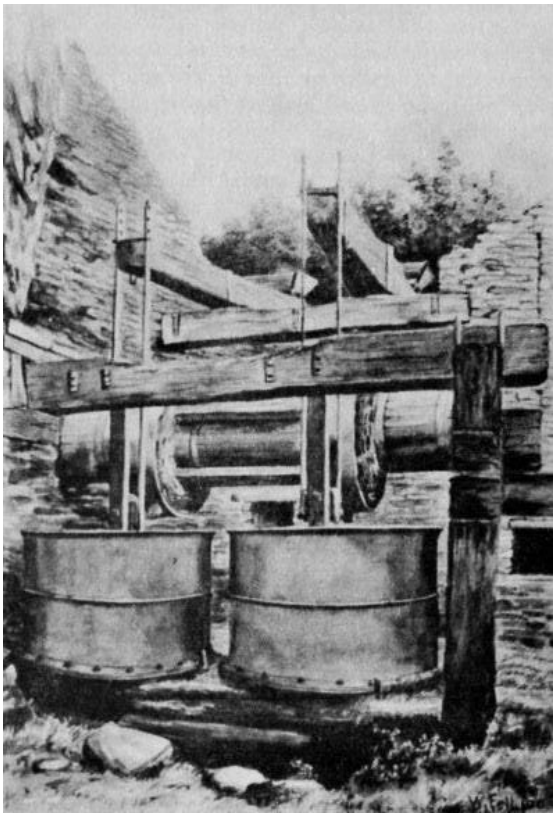
The means by which the blast of air into the furnace was created changed over time, and we have a clearer picture of how this was done in the first 200 years of the works than in the last 50, for which we have more questions than answers.

The location of the furnace close to the river was crucial in those early years. Water could be diverted off the river at a weir and brought in an open channel (a leat) so as to drop onto and turn the waterwheel next to the furnace. Connected to the axle of the wheel would have been a pair of leather bellows held in a wooden frame. As the axle turned it raised and lowered a series of cams which in their turn opened and closed the bellows, helped by counterweights. Closing the bellows pumped into the hearth of the furnace via a couple of nozzles called tuyeres. The bellows alternated, so producing a continuous blast of cold air, as shown below.



This set-up was replicated when the 'new' furnace was built. The leat was enclosed and extended along behind the furnace stack to a new waterwheel just beyond it. This wheel – 20ft in diameter and 3ft 6ins wide - was installed at 90 degrees to the furnace, so turning in parallel to the bellows from which air was blasted through the blowing arch into the hearth.

By 1889 the bellows had been replaced by a pair of blowing cylinders like the ones at Nibthwaite Furnace shown below, and still worked off the waterwheel. The raising and lowering of the cylinders created the blast in a similar way to the bellows. In that year those at Backbarrow were recorded as being 4ft 6ins in diameter with a 4ft stroke and driven at the rate of 4-5 strokes a minute.



In the early 1900s changed over from cold blast to hot (see Stoves). The first stone-built oven used for this was built near to the blowing arch so that air could be blown through it to pick up heat and become the hot (or at least warm) blast for the furnace hearth. We only have one photo showing this oven which leaves us with a question. Was there room for the blowing cylinders to remain next to the waterwheel, with their blast diverted via the new oven? Or were they relocated behind the oven, perhaps in the newly constructed power house, for which we do not have an exact date? If relocated how were they worked, as they could no longer be driven by the waterwheel?

Around 1910 this stone-built oven at ground level was replaced by 3 brick-built stoves at road level. Air was blown into these by a blowing engine driven by a steam engine in the newly built engine house (see Steam). This blowing engine was constructed in such a way that air was pushed out of it on both the forward and return stroke of the piston rod of the steam engine, so creating a continuous blast. In other words a reciprocating air pump. We think this is a rare example as we can find no others described in print or on-line.

Although the blowing engine remained on stand-by for longer, it became redundant with the introduction of electrical power to the works (see Electricity). The ironworks valuation of 1941 gives us some clues as to the machinery installed, but is not clear enough in either its descriptions or accompany plan to give us enough information to work out what was happening where and when.

The valuation lists "3 BTH 75hp Parson Blowers with Brook panel starters and equipment as housed in the blower house, all in good condition and capable of operating". This would suggest that the machinery was not in use at the time. These notes from Graces' Guide may help with interpretation..

BTH is British Thomson Houston Co., makers of electrical systems and steam turbines
C.A.Parsons & Co of Newcastle, makers of steam turbines, generators, alternators, centrifugal blowers
Brook, Hirst & Co of Chester, makers of electrical switchgear

The accompanying plan of the works divides the building concerned into four – "the steam engine house, the pump house, the turbine engine blower, and the Willan's engine house". The "turbine engine blower" is the section nearest the furnace, which presumably housed the 3 blowers.

The "Willan's engine house" is the section which today has a deep basement and an amount of pipework. The valuation describes the contents thus …

"The Willan Robinson engines with plant condensors (in use), in fair condition and capable working order
Gauges and valves complete with tachometer by Schaffer.
As two separate units housed in one engine house (*N.B. not the steam engine house*), and steam jet condenser in basement pit.
The whole as complete installation."

Graces' Guide lists Schaffer & Budenberg of Manchester as makers of pressure gauges, tachometers etc.
Wikipedia says "The Willans engine was a high-speed stationary steam engine used mainly for electricity generation around the start of the 20th century".

All of this would suggest that at some stage steam was used to generate electricity to power the blowers, instead of that generated by the water-powered turbines in the pugmill, but all is still open to interpretation.

Our interview with Bill Walker emphasised the importance of electric power, however generated: "…. the most vital was for the air compressor for blowing into the furnace via the tuyeres. If this failed there was rapid response from the fitter and mate – bordering on panic, they had to get it going as soon as". A further complication is in understanding the role of the compressed air receiver which once stood outside the blower house (see below) but now sits unconnected inside the engine house. (From a photo dated 1900/1910).

Our research into the blast and other aspects of the ironworks is on-going. Please get in touch if you can add to our knowledge of this fascinating place.

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