Air Boiling of Iron.—Another Claimant.

Messrs. Editors—In November, 1851, I commenced a series of experiments with a view of converting fluid pig metal into malleable iron, with the aid of a strong blast of air, and without the use of fuel, which process I termed "air boiling." My object was to drive off the carbon in the iron, and to make powerful blasts of air do the work of the fire and the manipulation of the puddler's bar in the puddling process. My first efforts were quite satisfactory, as with a blast taken from my furnace and introduced into a suitable cupola filled with liquid metal taken directly from the furnace I produced a fair article of malleable iron. I found when using gray iron cold blast answered my purpose, but when the metal was white I found hot air had a better effect. I therefore had a small furnace erected to heat the air in the blast pipes.

My experiments were conducted publicly at this establishment; hundreds of persons called to see the trials I made, and the subject was discussed amongst the iron masters, &c., of this section, all of whom are perfectly familiar with the whole principle and object I had in view, as discovered by me nearly five years ago.

I was surprised to notice in the Scientific American of the 13th Sept. an account of a similar process of converting pig iron into malleable iron, claimed as the discovery of Mr. Bessemer, of London, and made within the past two years, the process not differing in the slightest from that I had in practical operation nearly five years since.

I have reason to believe my discovery was known in England three or four years ago, as a number of English puddlers visited this place to see my new process. Several of them have since returned to England and may have spoken of my invention there.

A charcoal furnace such as I have—using cold blast—produces various grades of metal, that I found had to be treated in the air boiling process with some variation; this caused difficulties which I have succeeded in removing, and expect shortly to have the invention perfected, and bring it before the public.

William Kelly.

Suwanne Iron Works, Eddyville, Ky., 30th Sept. 1856.

Bessemer's Process.

Having been solicited to give some expression to my views of Mr. Bessemer's method of convertiug crude metal into steel or wrought iron, it may not be inappropriate to do so through the columns of your valuable journal. Mr. Bessemer furnishes a clear and detailed description of his apparatus, method of treatment by atmospheric air, informing us of the chemical changes produced, and claims the resulting product to be at the pleasure of the operator, "fine steel, or masses of malleable iron perfectly free from any admixture of cinder, oxyd, or other extraneous matters," equal in quality to charcoal iron.

Iron or steel, perfectly free from any admixture of cinder, oxyd, or other extraneous matters; in other words, absolutely pure iron, is not the article those engaged in their manufacture should seek to produce.

Let us, for illustration, examine the chemical composition of a few varieties of iron and steel, and ascertain whether Mr. Bessemer's proposition, that the nearer absolute purity we approach in the production of iron, the more useful qualities that iron will be possessed of.

The following table represents the chemical structure of several kinds of iron and steel, viz., No. 1, English gray cast-iron; No. 2, English refined; No. 3, Danemora Swedish; No. 4, German; No. 5, English common steel; No. 6, English, best razor steel :—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6
Iron,	94·63	98·90	98·78	99·87	97·94	93·80
Carbon,	2·60	0·41	0·84	0·09	1·72	1·43
Sulphur,	0·35			trace		1·00
Phosphorus,	0·39	0.40				
Silicon,	1·53	0·08	0·02	0·03	0·22	0·52
Arsenic,			0·02		0·07	0·93
Antimony,						0·12
Manganese,	0·50	0·04	0·05		0·02	1·92
Copper,			0·07			
Nitrogen,						0·18

Here we find that the English crude iron approaches nearer metallic purity than the best English razor steel; and the Swedish, possessing less purity than English refined iron, yet capable of sustaining over 72,000 pounds to the square inch, while the latter breaks at about 55,000; and the German iron, which is the nearest approach to absolute purity, although possessing fibers, is so soft and weak, as to be of less value than either.

For one, I must state that experience has heretofore taught, that the quality of the manufactured iron depends more upon the description of ore and fuel, made use of in its first production, than upon the manner of subsequent treatment. It is in the blast furnace, and not afterwards, that the character of the iron produced is determined. The superior qualities of the Swedish Danemora iron are alone due to the peculiarly fine magnetic ore from which it is manufactured, and not to the manner or method of manufacture. Other districts in Sweden produce iron by the same process, and from a somewhat similar magnetic ore, but their products will not bear comparison with the Danemora in mercantile value. It is to the Danemora iron Mr. B. refers, as selling in England at thirty pounds sterling per tun, the future sales of which are to be estopped by his invention. There are many cases in which wrought iron contains a larger proportion of impurities than crude iron, and is yet malleable and useful, while cast iron of the same chemical composition will be extremely hard and brittle.

Berzelieus, the celebrated Swedish chemist, informs us that he det ected eighteen per cent. of silex in a certain kind of bar iron, and that this iron was still malleable and useful. One-tenth of that amount of silex will make crude iron brittle. The best qualities of bar iron are always found to contain a small amount of impurities. Steel ceases to be hard and strong if we deprive it of the small amount of silicon it contains, or if by repeated heating that silicon becomes oxydized. This is the case with bar iron. Deprive it of all foreign admixtures, it ceases to be strong, tenacious, beautiful iron, and becomes a pale, soft metal, of feeble strength and of doubtful utility. The main difference between crude and malleable bar iron consists in their mechanical, rather than chemical structure. Crude iron is a mixture of impurities and metal, both chemically and mechanically combined, where the atomatic crystals are found in intimate contact with each other, and in which a trassformation to an entirely chemical admixture is readily effected. Wrought iron is a mechanical mixture of iron more or less pure, with a mass of homogeneous impurities or cinder, the latter filling the spaces between the particles of iron. Iron, in a connected form, and cinder in separate cells, are thus blendid in one homogeneous mass. The more this is stretched, either by the hammer or rolls, the more fibrous it becomes, and other circumstances being equal, the strength of the iron will be proportional to the fineness of the fibers.

Mr. Bessemer appears to congratulate himself upon the excessively elevated temperature that he obtains in the latter part of his operation, or after the entire consumption of the contained carbon; in plain terms, by oxydizing or burning the iron. This oxyd, we are told, from the elevated temperature that the metal has acquired as soon as formed, undergoes fusion, and forms a powerful solvent of those earthy bases that are associated with the iron. I am at a loss to comprehend how this is effected; having heretofore supposed that the melting of such an oxyd could not be effected at any temperature in an oxydizing flame, which Mr. Bessemer's clearly is. This immediate melting of the oxyd, as described, I cannot deem other than a physical impossibility.

The lower the temperature that crude is worked at, the better will be the quality of the wrought iron produced. Good bar or wrought iron is always fibrous, it loses its fibers neither by heat nor cold. Time may change its aggregate form, but its fibrous quality should always be considered the guarantee of its strength. Fine malleability and fibrous structure can only be given to iron by a tough cinder and manipulation. Mr. Bessemer does not pretend to do this, but rather rests upon the demonstration of his ability to produce a crystaline metal, which, although free from either carbon or cinder is not known to possess any practical value, and which, leaving his apparatus in the chemical state he alledges it to be in, I have no hesitation in asserting that it cannot be hammered or rolled sufficiently to produce any fiber, and all subsequent improvement of its quality will prove to be extremely difficult.

From the remotest antiquity down to the present day, wrought iron, unsurpassed in quality has been produced by one manipulation direct from the ore, but the great consumption of fuel and labor attending this method of manufacture, has enabled the blast, and puddling furnaces to supersede it, excepting where quality is of greater consideration than quantity. Men of the first scientific attainments have, of late, given expression to the opinion, that the blast and puddling furnaces, are soon to be superseded by the introduction of improvements upon the direct method of producing wrought iron.

Such improvements have been made and can now be seen in operation under my charge at the works of the American Magnetic Iron Co. at this place. J. G. Miner.

Mott Haven, N. Y., Oct. 7, 1856.

Refining Iron.—The New Process.

Since the first announcement of this discovery by Mr. Bessemer, the matter has been taken in hand experimentally by a leading American iron-master, assisted by a distinguished chemist, but the results thus far do not confirm the high anticipations which some have entertained. The most carefully performed experiments on this side of the Atlantic have utterly failed to produce *fibrous iron*, and the specimens sent over from England as fibrous iron, do not, upon examination, possess this character.

The Locomotive Explosion.

Messrs. Editors.—I have been to the Boulton station of the Baltimore and Susquehannah, or Northern Central Railroad, where I had opportunity to examine the character of an explosion that occurred on the morning of the 1st inst., to one of their engines. The fracture was at the upper edge of the bottom sheet, on the right side of the fire-box, running about two feet along the rivet line, and tearing irregularly down about 12 to 14 inches, opening an area of about two and a half square feet. The sheet, along the rivet line, does not average more than one-eighth inch in thickness, while it was originally five-sixteenths or perhaps three-eighths.

Great heat and galvanic action between the copper sheet and the iron of the rivets and stay-bolts, had been doing this work till a great reduction of thickness under the rivets, and destruction to a great extent of the screw threads connecting the stay bolts, had taken place; there was also a great deficiency of head to the stay bolts, which afforded, as a whole, an abundant cause for this disaster.

Mr. Winans, the builder, and the master of machinery, were present, and seemed to console themselves with the remark that "it was one of those unavoidable and unaccountable accidents that no one could guard against." With all deference to the authority, I must protest that it is one of those cases that *could* and *should* have been guarded against, and I am strengthened in this opinion by the remark of the master of machinery, that "within a week it would have been overhauled, that they knew it needed repair."

The fact is, the boiler thus weakened was given over to the fireman to get up steam for an early start. There are now no external means of knowing the stage of water or the condition of the safety valve: he probably built a strong fire, and with steam even above the ordinary pressure may have been renewing the fire with a fast valve, and without a pressure gauge, when the explosion occurred. The fireman was thrown several yards from the engine, and it is supposed was instantly killed. The engine was capsized. "Nobody to blame."

I repeat what I have before written, and what every new examination of such disasters confirm; it is not necessary that another steam boiler explosion should ever occur. Science, experience and skill have made the path of safety plain, and only ignorance, neglect, or fool-hardiness will ever leave that path, and it is time engineers and pretenders to science ceased to gull the public with the idea of unavoidable explosions. Joseph E. Holmes.

Baltimore, Md., Oct. 2, 1856.

Locomotive Engines for Propellers.

On page 188, last volume Scientific American, we illustrated the application of high pressure steam, on the locomotive principle, to the propulsion of propellors, according to patent of Capt. Whittaker, of Buffalo, N. Y. The advantages, in comparison with paddle wheels were pointed out, and the economic results of the side propellers of Capt. Whittaker, applied to the steamer *Baltic*, on Lake Erie, were given. In previous articles we had expressed the opinion that this mode of propulsion impressed us favorably, and we directed the engineering fraternity at home and abroad to examine it thoroughly. We are not aware that any attempts have been made in New York, or any of our Atlantic cities, to apply this principle of propulsion, but from the Leeds (Eng.) *Mercury*, we learn that it has recently been applied there. It says :—

"An interesting trial lately took place at the Railway Foundry, Leeds, in the presence of the Government Inspector, and other scientific persons, of a novel application of locomotive high-pressure machinery to marine purposes. The machinery, which has been arranged and completed from designs of the engineer of the works, is intended, we understand, for a screw steamer recently launched at Hull. Nothing could apparently be more admirable than the smoothness and facility with which the machinery worked, a speed of 120 revolutions of the screw shaft per minute being obtained from the direct action of the engines, without the intervention of multiplying gear. This quickness of piston motion, which is not attainable at low pressure, is one of the main advantages of the application. Another is the great saving of space and weight, amounting to more than one-half.—But what seemed to excite admiration most was the ease and quickness with which the motion was reversed, which was repeatedly effected under unfavorable circumstances, and against the full steam pressure of 140 lbs. on the inch, seven or eight times within thirty seconds. Upon the whole, it is not too much to say that this very admirable arrangement bids fair to supersede all other applications of steam power to marine purposes, especially for screw steamers."

The views presented in this extract are similar to those expressed in our columns, and the engineer who designed the machinery for the Leeds steamer has probably seen and read the illustrated article referred to above.

Strychnine, its Tests.

Prof. Horsely, of England, has tried experiments with strychnine on rats and dogs, and in some cases was unable, by any of the usual tests, to detect the poison. He is of opinion that it combines, in some cases, with the albumen, or other solid matter, in the body, and forms an insoluble compound. He has, however, discovered a most beautiful and simple test for it, which will always detect it when not combined with organic matter as an insoluble compound.

The test is, one part, by measure, of the bichromate of potash dissolved in fourteen parts of water and two parts of strong sulphuric acid. By adding a few drops of this solution to another, supposed to contain strychnine. If the poison is present, a precipitate of a golden color will be formed, which is an insoluble chromate of strychnine. This test is exceedingly sensitive, and can detect very minute quantities of strychnine in any solution.

The National Fair.

The United States Agricultural Association held its grand Exhibition at Philadelphia last week. The display of animals was good, but it is a fact to be regretted, that this Society depends most for success at its Fairs upon races and cavalcades of men and women on horseback.

New Cement.

A little ground borax mixed with plaster of paris makes an excellent cement for many purposes. It is simply mixed up into a plastic consistency, then applied with a trowel.—It soon hardens.