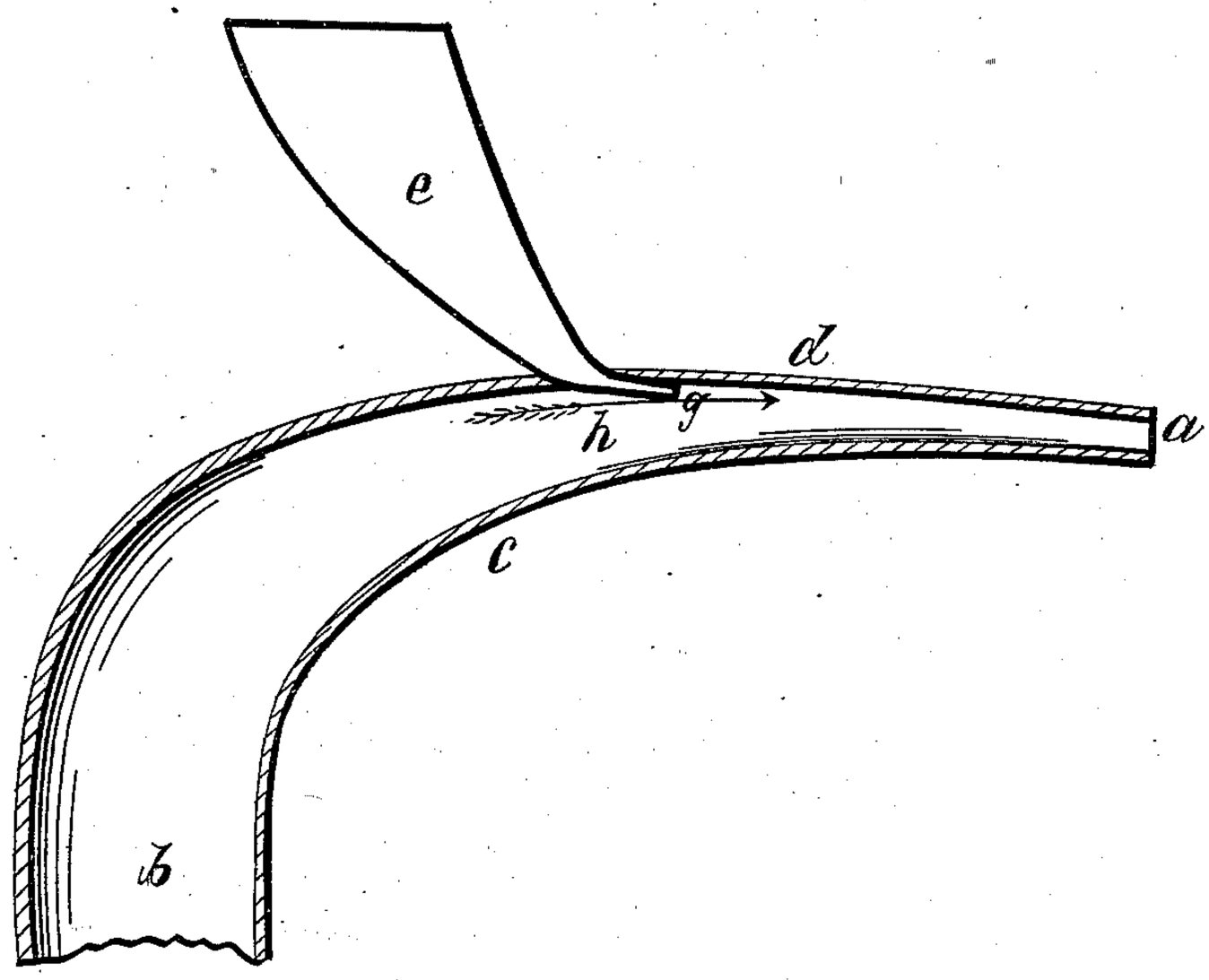
W. W. HUBBELL.

Smelting and Refining Iron.

No. 99,677. Patented Feb. 8, 1870



Witnesses:

Joseph Eggard

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UNITED STATES PATENT OFFICE.

WILLIAM W. HUBBELL, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN SMELTING AND REFINING IRON.

Specification forming part of Letters Patent No. **99,677**, dated February 8, 1870.

To all whom it may concern:

Be it known that I, WILLIAM WHEELER HUBBELL, of the city of Philadelphia, and State of Pennsylvania, have invented a new and useful improvement in the method of smelting and refining iron and iron ore and other metals or metalliferous ores; and I hereby declare the following to be a full, clear, and exact description thereof.

The nature of my invention consists in supplying pulverized saltpeter to the blast-pipes or tuyeres of the furnace in which the iron or ores is or are being melted, so that this pulverized saltpeter shall be driven with and by the blast into the furnace in direct contact with the melting iron or ores or close to the surface of the molten iron. This pulverized saltpeter, being in fine particles, readily enters into combustion with the sulphurous and carbonaceous matter in the furnace, and so largely frees the sulphur from the iron that it becomes thereby highly purified and is rendered strong or tough and tenaceous. It also makes it more readily convertible into steel. Iron thus prepared becomes important for the manufacture of large guns or ordnance, which should be cast from a furnace in which the smelting operation is conducted by the use of saltpeter in this manner. Nitrate of soda, pulverized, as well as nitrate of potash, may be used in this manner to smelt the iron; or other pulverized salts which evolve oxygen when brought into contact with the fire in the furnace may be used.

Various common mechanical devices may be employed to measure and deliver the saltpeter into the tuyere or tuyeres of the furnace. I introduce it by means of a tube entering into the top of each tuyere, the tube sloping or inclining in direction toward the furnace, by which inclination the passing current of air in the tuyere sucks or draws the pulverized salts into the tuyere. The tube should enter the tuyere about half an inch. The pulverized salts are measured into the tube from a box above containing it, by a sliding bar containing a chamber or chambers, which receive the powder and drop it into the tube close to its mouth.

Various other modes of measuring the powder into the tuyere may be employed—namely, a wheel with chambers in its periphery or through its sides may be employed to measure the salts from the box; also a plunger may be used to force the salts into and along the tube into the tuyere. The supply-tube should enter the tuyere on the top of its barrel portion, between the bend and its nozzle or mouth, so that the air shall not drive the powdered salts back into the supply-tube. About twenty pounds of salts may be used in smelting one thousand pounds of metal, though more than this quantity may be used.

I do not mean to confine myself to any particular proportion of salts, nor to any particular device to supply it to the tuyere or tuyeres. Each tuyere should have its own feeding device. Using one hundred pounds of the powdered saltpeter to one thousand pounds of iron will decarburize the iron and convert it into steel or malleable iron, or into more or less refined cast-iron, dependent upon the quantity and kind of fuel used, which may be charcoal or anthracite or bituminous coal or other fuel.

Another method of supplying the saltpeter to the tuyeres, so that they may direct it with the blast into the furnace, and which is well suited to the cupola-furnace for smelting pig-iron where a fan-blower is used, is to feed the powdered saltpeter in at the eye or side of the fan-blower by means of a hopper and shoe by shaking them in the usual manner of feeding flour or grain. The mouth of the shoe is placed close to the side or eye of the fan-blower, and the air entering there sucks or draws the powdered saltpeter with it, and forces it through the tuyeres into the fire of the furnace.

The annexed drawing represents a sectional view of one of the tuyeres with the small pipe to feed the saltpeter through into it, in which *a* is the discharge mouth or nozzle of the tuyere. *b* is the portion leading to the blower. *c* is the lower, and *d* the upper, side; and *e* is the pipe to feed the pulverized saltpeter, *g* being its mouth, which is directed toward the nozzle *a*. The blast, therefore, in rushing past the mouth *g* in the direction indicated by the arrow *h*, tends to suck the saltpeter through the pipe *e*, and the blast carries the powdered saltpeter into contact with the metal at the points of combustion or smelting portions of the metal, wherever the blast itself goes in contact with the molten and melting metal and

fire, and with their oxygen thus supplied consumes the sulphur and carbon and combustible matter and purifies the iron, giving it or causing it to possess great purity and strength. The saltpeter may be fed into the pipe *e* by a shoe and hopper, or a screw, or any other device. When the saltpeter is fed into the blast at the eye of the blower, the pipe *e* should be set with its mouth *g* presented to the eye of the blower, the body of the pipe *e* extending upward above the eye to near the top of the case of the blower, and a shoe or shaker is placed above it to shake in the saltpeter from a hopper above the shoe. This forms an equivalent mode of combining the pipe *e* with the tuyere, so that the blast shall suck in and carry the saltpeter through the tuyere into the furnace, as before alluded to in this specification.

In casting ordnance, I recommend a repeated smelting of the pig-iron or iron by this process before running it into the mold; and also I recommend the use of charcoal for fuel. The iron should be smelted twice before the final smelting, each time running it into bars or pigs and letting it cool, and using about twenty-five pounds of refined saltpeter to each thousand pounds of pig metal. After the second smelting, it can be stored away for use when needed. On the final smelting for casting into the gun, fifty pounds of refined pulverized saltpeter may be used to each thousand pounds of iron. The last smelting for ordnance may be with charcoal fuel alone without the application of the saltpeter. Refined saltpeter is far better than crude, though I do not limit as myself to the quality of the saltpeter in respect to the principle of my invention.

In this invention I do not mean to limit myself to any particular means or method of feeding the pulverized saltpeter to the tuyere; and it may also be supplied through a separate blow-pipe or supplemental tuyere, but not so advantageously.

I do not mean to limit myself to the use of any particular proportion of saltpeter at each or any smelting, nor to any certain number of smeltings of the iron. The quantity of saltpeter may be greater or less than I have named, and the number of smeltings may be greater or less. They are all contemplated by me, and are each and all within the scope and intention of my invention, as here specified. The pulverized saltpeter on this principle may be supplied, also, in the smelting of the ores of gold, silver, copper, or other metalliferous ores, they all being comprehended within my invention, and application of the pulverized saltpeter by means of or with the blast, as here specified and claimed, or intended so to be. By this means the oxygen supplied and developed is brought in contact with every particle of the metal and combustible matter, and the most uniform purification and separation of the metal from all sulphur and earthy matter are effected. Refined saltpeter is the best to use, as pure as possible, and I recommend it, and it should be pulverized very fine previous to use in this smelting operation.

Any suitable flux may be used—limestone or other—and I contemplate using it in connection with my flux of sulphate of baryta, patented by me May 4, 1869. It may be also used in the ordinary smelting-cupola without a flux.

I am aware that oxygen salts have been converted into gas and forced into a molten mass of metal below and into its surface to purify the mass after it was smelted, and I do not claim any construction to carry on this process. Such process is impracticable to purify a large mass of fused metal and still have it in proper condition or degree of fusion to cast large bodies to be very strong. With my process of purifying the metal when detaching itself in small particles at the point of fusion, the metal, when settled in mass or in the bottom chamber of the furnace, can be accumulated in large body and cast when at the proper heat or state of fusion to make a strong casting, which state of fusion experienced founders well know on sight of the fluid metal; also, my process produces a more thorough combustion of the sulphurous and carbonaceous matter of the fuel and metal by uniting the oxygen immediately with it and the metal in particles together at the fusion-point.

What I claim is—

1. The supply of the pulverized niter with and by means of atmcspheric air above the molten mass of iron at the point or place of fusion of the metal, by means of the feed tube or shoe *e*, connected to the ordinary blast-tuyere of the furnace, or its equivalent shoe or tube at the eye of the fan-blower, substantially as described.

2. The smelting of the iron repeatedly or successively by this same process, before claimed, so as to be able to accumulate it in a purified condition to make very large castings stronger and more pure, as described.

WM. W. HUBBELL.

Witnesses:
JAS. G. SMITH,
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