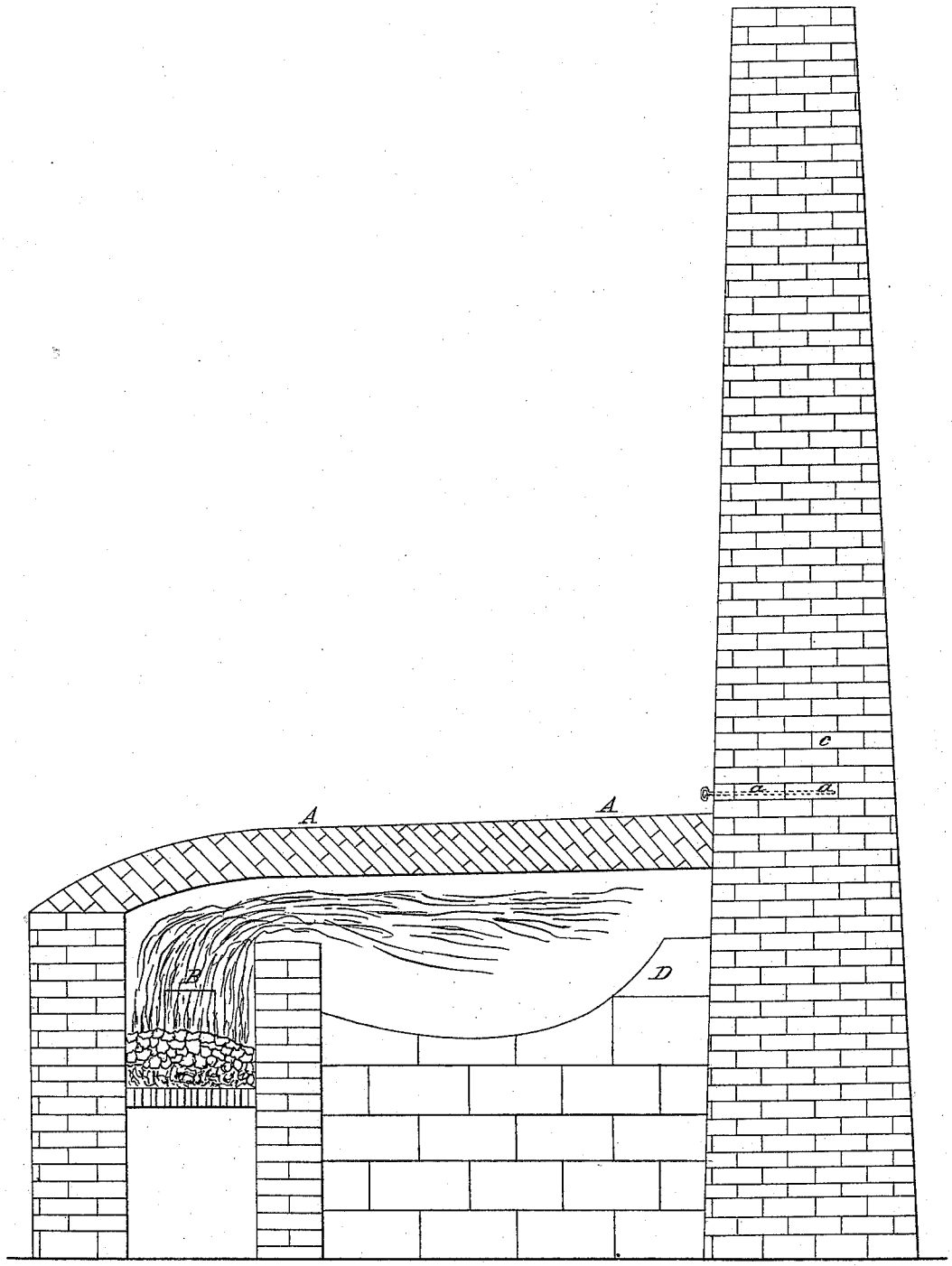
S. BROADMEADOW.

Making Iron Direct from Ore.

No. 3,605. Patented May 30, 1844.



UNITED STATES PATENT OFFICE.

SIMEON BROADMEADOW, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MODE OF OBTAINING WROUGHT-IRON DIRECTLY FROM THE ORE.

Specification forming part of Letters Patent No. **3,605**, dated May 30, 1844.

To all whom it may concern:

Be it known that I, SIMEON BROADMEADOW, of the city of New York, in the State of New York, have invented a new and useful Improvement in the Process of Manufacturing Iron, by means of which improvement I am enabled to obtain malleable iron directly from the ore by treating the same in a puddling-furnace; and I do hereby declare that the following is a full and exact description thereof.

The form that I in preference give to my furnace is somewhat different from that usually given to the puddling-furnace, as will be seen by reference to the accompanying drawing, which represents it as having one of its side walls removed for the purpose of showing the form of the interior.

A A is the arch or roof, which, instead of curving down as it approaches the chimney, rises regularly from that part which is above the fire-chamber as it approaches the stack, which it may do at an elevation, say, of about ten degrees. It may, however, pass horizontally, or even be slightly depressed, without materially interfering with its action. The object of giving to it this form is to prevent its taking the character of a reverberatory, as the reflecting of the flame and heat so as to cause them to reverberate or impinge upon the ore converts the larger portion of it into slag, instead of reducing it into malleable iron. I also elevate the hearth of my furnace at its rear end, and prefer to do this to such an extent as to contract the throat or opening from the furnace into the flue, so as to make it much less than in the ordinary reverberatory, which is usually about two feet, or two feet six inches, while I reduce its height between the floor and the roof to about one foot. In the lower part of the chimney, as at *a a*, I place a sliding register or damper which I can close at pleasure, so as to retain and regulate the heat, such regulation being essential to the success of my process. In a furnace so constructed the mineral and the metal obtained therefrom will be sufficiently heated to produce the intended effect; but the form of the furnace may, as above indicated, be varied to a considerable extent without materially interfering with its use, and there have probably been puddling or other furnaces constructed which, under due management, might answer the purpose equally well with that described. I do not intend, therefore, to make any claim to the particular form of the furnace which I have described, but only to indicate the main conditions necessary to the success of the process.

In my process of reducing the minerals to the metallic state, I do not use any of the earthy or other fluxes which are employed in the smelting of iron; nor do I of necessity mix therewith any carbonaceous matter, as has been uniformly done in the attempts heretofore made to manufacture malleable iron directly from the ore. The most notable of these is the process for which Letters Patent were obtained in England by W. N. Clay, dated on the 31st of March, 1841, and published in the "Repertory of Patent Inventions" for that year. In that patent a claim is made to the mode of manufacturing wrought or malleable iron in reverberatory furnaces from iron ore by combining therewith twenty-eight per cent. or upward of carbonaceous matter. In my process, on the contrary, I employ the ores of iron alone by mixing together in due proportion such ores as by their chemical composition are calculated to react upon each other when duly heated, and to bring the metal contained in each of them into the malleable state. I take any of the ores which are known as "oxides of iron," which I reduce to coarse powder, and with this I mix a due proportion of the ore known as a "carburet of iron," also in powder. This mixture I put into my puddling-furnace, and by means of anthracite or other fuel I subject it to the proper degree of heat for effecting the reduction. The mass so placed in the furnace I do not stir, but leave it at rest until I find that it is brought into a state in which it is prepared for balling, which condition is produced in consequence of the union of the carbon of the carburet with the oxygen of the oxide and the consequent production of particles of iron in the malleable state.

When charcoal or other carbonaceous matter is mixed with the ore which is to be reduced, the carbon will begin to combine with the iron in the oxide which is to be reduced before the oxygen of said oxide is so far disengaged as to be ready to combine with it, and the metal will become highly charged with carbon, and the whole contents will consequently be converted into a fluid mass, and this may occur notwithstanding the utmost care on the part of the operator, a very slight deviation in making the mixture or in the heat

to which it is subjected, converting the materials into slag; but when the mixture consists entirely, or nearly so, of the ores to be reduced, as above described, there may be a considerable variation in the temperature without deteriorating the mass, the carbon of the carburet and the oxygen of the oxide being given out simultaneously, and these by their affinity combining with each other the iron of both the ores will be left in the metallic state, requiring only to be balled up.

It will be manifest to any one acquainted with the nature of ores that in mixing them no proportionate quantities can be designated, as scarcely any two ores will be found to be identical in composition; but the proportionate quantities may be learnt from analysis or will readily be ascertained by experiment in the hands of a competent iron-master.

Although the addition of carbonaceous matter is not necessary in my process of reduction, I do not interdict its use, as it is manifest that a deficient proportion of carburet might find its compensation in such addition; but this would be only a variation of and not a departure from the principle upon which I proceed.

When the iron is ready for balling, the slag is to be removed and the balling is to be effected in the ordinary way, the working and feeding doors, the tap-hole, and the general appendages of furnaces for this purpose being such as are well known.

Having thus fully set forth the nature of my improvement in the process for obtaining malleable iron directly from the ore of that metal, what I claim as new therein, and desire to secure by Letters Patent, is—

The effecting of such reduction by mixing in due proportion the ores known as "oxides" and as "carburets" of iron (without the necessary admixture of fluxes or carbonaceous matter) and exposing them to a proper temperature for fusing the same in a furnace so constructed that the flame shall not reverberate upon the mass, but shall pass over it in contact or nearly in contact therewith.

SIMEON BROADMEADOW.

Witnesses:
THOS. P. JONES,
WM. BISHOP.