

J. PEDDER & G. ABEL.
Manufacture of Iron and Steel.

No. 137,621.

Patented April 8, 1873.

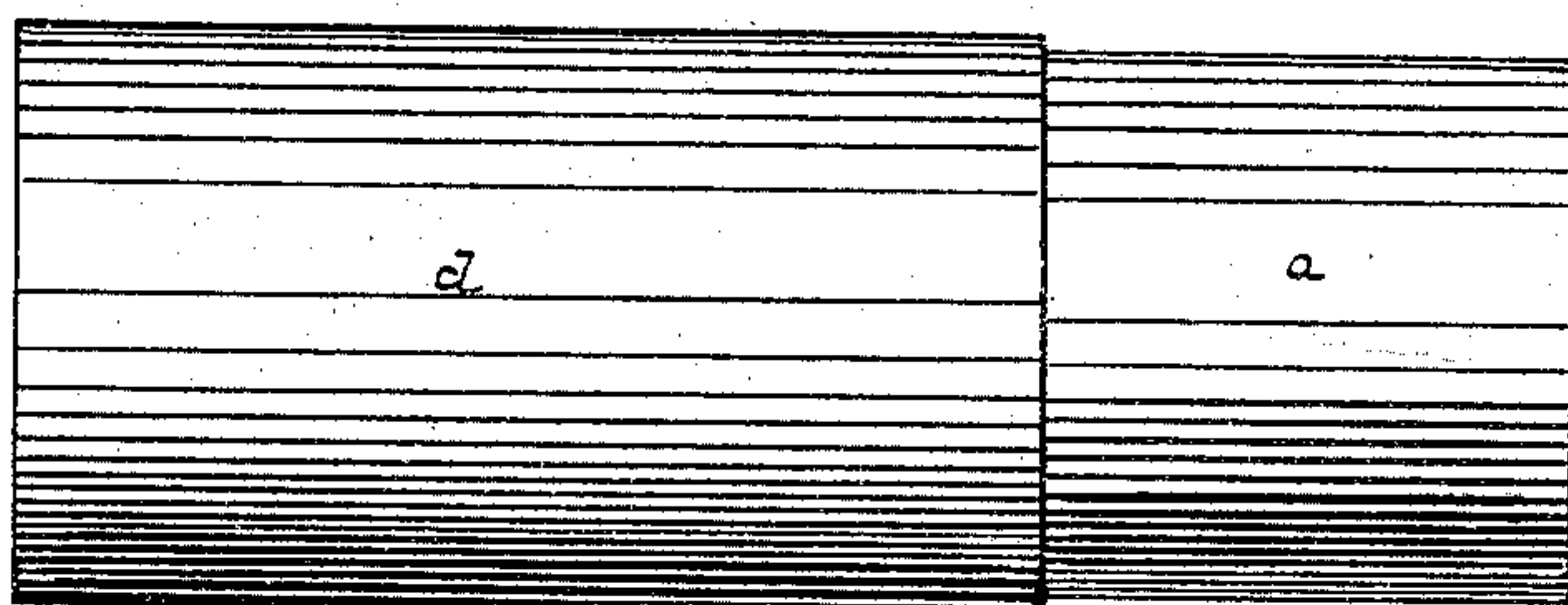


Fig. 1.

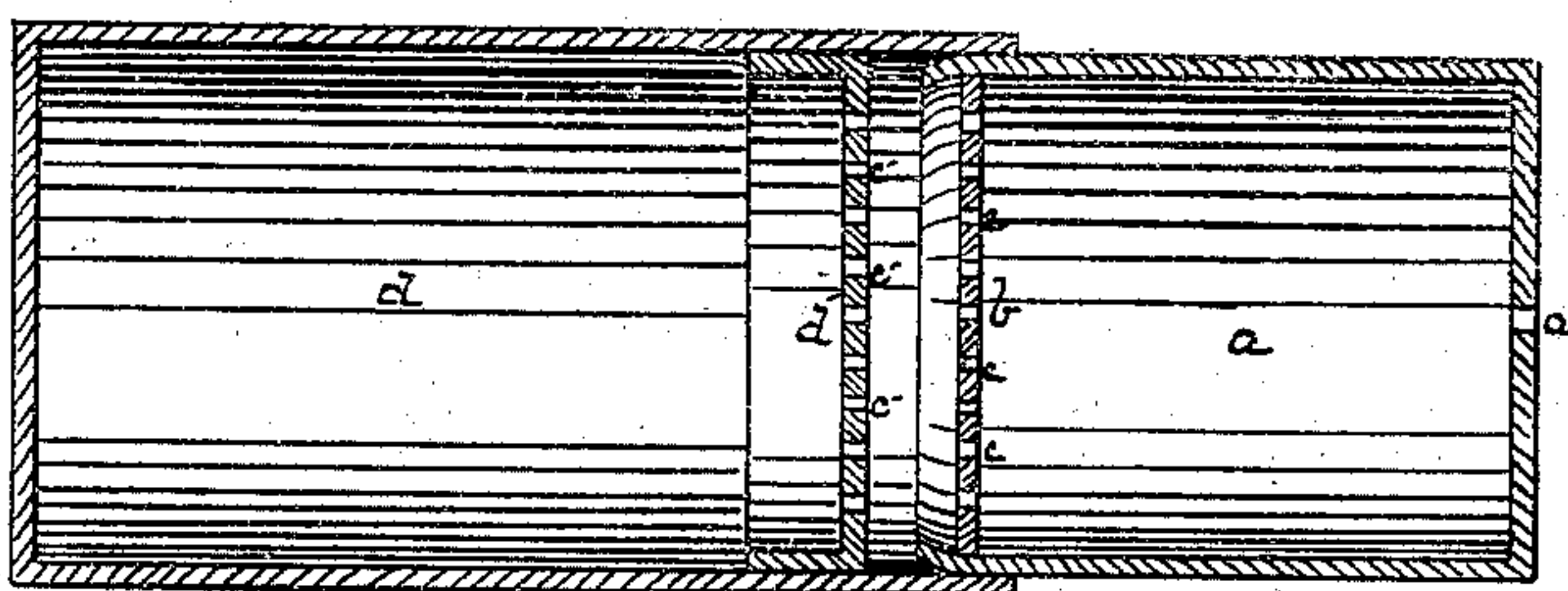


Fig. 2.

WITNESSES
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UNITED STATES PATENT OFFICE.

JOHN PEDDER AND GEORGE ABEL, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN THE MANUFACTURE OF IRON AND STEEL.

Specification forming part of Letters Patent No. **137,621**, dated April 8, 1873; application filed March 21, 1873.

To all whom it may concern:

Be it known that we, JOHN PEDDER and GEORGE ABEL, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Manufacture of Iron and Steel; and we do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing making a part of this specification, in which—

Figure 1 is an outside, and Fig. 2 a sectional, view of the cases employed in connection with our invention, and as a part thereof.

Like letters of reference indicate like parts in each.

Our invention relates to the manufacture of iron and steel direct from the ore, by the introduction of carbonaceous gases from one chamber, in which they are generated or evolved under heat, into another chamber, in which are inclosed the ore or metallic oxides, the latter chamber being practically closed against the introduction of any but the carbonaceous gases.

To enable others skilled in the art to make and use our invention, we will proceed to describe the same.

The ore, which is chemically a metallic oxide, is, with such fluxing material as may be desired or required, and hot or cold, inclosed in a metallic case, *a*, the end left open for charging being, after the case is charged, closed by a lid, cap, or diaphragm, *b*, which is held in place in any suitable way. This diaphragm has any desired number or arrangement of perforations, *c c*, of comparatively small size, but sufficient in size and number for the inflow of carbonaceous gas or vapor, which is driven off from the carbonaceous material, which is inclosed in a suitable chamber, *d*. This chamber is likewise closed at its charging end by a suitable diaphragm, *d'*, in which are perforations *c'*, as before. The chambers are then brought end to end, with the perforated diaphragms toward each other, and being properly secured, are subjected, in any suitable furnace or heating-chamber, to the action of such degree of heat as will drive off, generate, or evolve carbonaceous gases or vapors from the carbons in the chamber *d*. These gases or vapors, having no other egress, must pass through into the chamber *a*, where they act on the metallic oxides or ore in the man-

ner well known in the treatment of such oxides or ores, and the gaseous product is allowed to escape from the opposite end of the case *a* by any suitable escape-port, *a'*. In such treatment the ore should be raised to about a red heat, or, if so desired, even higher, provided that the iron itself be not fused or melted. When the ore is reduced the ore-chamber is separated from the other; and if it has (and we generally prefer to make it so) a metallic case, such case and its contents may, by the hammer or rolls, or both, or by presses, be worked directly into a bloom; or, it may be placed directly in a bath of molten metal in any suitable furnace, pot, or crucible, be melted, and worked up into wrought-iron; or, with a portion or all the metallic contents of the furnace, be run off into pig metal; or, it may be used, under like conditions, in the manufacture of crucible or ingot steel; or, again, the case and its contents may be allowed to cool, and be disposed of, like pig metal or blooms, as an article of sale; but for many of the uses above indicated it is not essential that a metallic case be employed.

Any suitable material may be employed for the case *a*, like fire-clay or aluminous or silicated earths, and such as are infusible and incombustible at the temperature required for reducing the ores in the manner described, and which would not materially interfere with the further manipulation or treatment of the reduced ores.

The time required for such reduction of the ores will vary somewhat with the size of the charges, the degree of heat, the fineness of the ore, &c. With a charge in the case *a* of three or four hundred pounds, and a corresponding amount of suitable carbonizing material in the case *d*, and a red heat, the reduction may ordinarily be effected in from four to eight hours; and the time required will be greater or less as the size of the charge is greater or less, or the degree of heat less or greater.

The product thus given as the result of the reducing operation, with what is commonly known as Lake Superior and Missouri ores, is a dark, brittle, non-lustrous substance, resembling, in its general features, what has long been known by the name of metallic sponge.

The carbon-chamber *d* may, if so preferred,

be built into the wall of the furnace in which the ore-charge is to be reduced, and be so arranged that the ore-case *a* may be directly connected therewith at pleasure, or placed in close juxtaposition thereto, so as to receive carbonaceous gases or vapors therefrom; and in such case, while the inner end of the carbon-chamber is suitably perforated, the carbon charge or charges may be introduced at the other end, and the work of reducing the ores be kept up continuously, a new ore-case being introduced as soon as the former one is removed; and several such carbon and ore chambers and cases may be kept in operation simultaneously in a single furnace; or, the carbonaceous material may be arranged in an outside retort, and the gases or vapors carried inside the reducing-furnace by a pipe, which shall be so made at its inner end that it may, at pleasure, be connected with or detached from the ore-case, so that when connected the gases or vapors from the pipe shall pass into the ore-case, as already described. Such pipe may have an outside cock for regulating the flow of the gas or vapor.

The object of inclosing the ore and the carbons in separate cases, as described, instead of in the same case, as has heretofore been done, is to avoid the loss of case-room and cost of case material resulting from the bulk of the carbons. A single carbon-case or retort, with one large or several small charges, may be used with a large number of ore-cases, with a consequent saving of expense.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The process of reducing metallic oxides by inclosing them, with suitable fluxes, in a case which shall be infusible and incombustible at a reducing heat, and while so inclosed subjecting them, at a reducing temperature, to the action of carbonaceous gases or vapors, or both, which gases or vapors are evolved or generated in a separate case or retort and introduced into the ore-case, substantially as set forth.

2. The combination of cases *a* and *d*, the one containing ore with suitable fluxes, and the other any suitable carbon, and a suitable perforated diaphragm, *b*, for closing the open end of the ore-case, such cases being suitably constructed for admitting, at pleasure, the gases or vapors from the one into the metallic contents of the other, substantially as set forth.

3. In the manufacture of iron and steel, charging the cases of reduced oxides so made into a bath of molten metal in a furnace, retort, or crucible, melting the same with such molten metal, and working up or drawing off the resultant product, substantially as set forth.

In testimony whereof we, the said JOHN PEDDER and GEORGE ABEL, have hereunto set our hands.

JOHN PEDDER.

GEO. ABEL.

Witnesses:

A. S. NICHOLSON,

G. H. CHRISTY.