A. DICKERSON.

Making Iron and Steel Direct from Ore.

No. 7,519. Patented July 22, 1850.

Fig. 1.

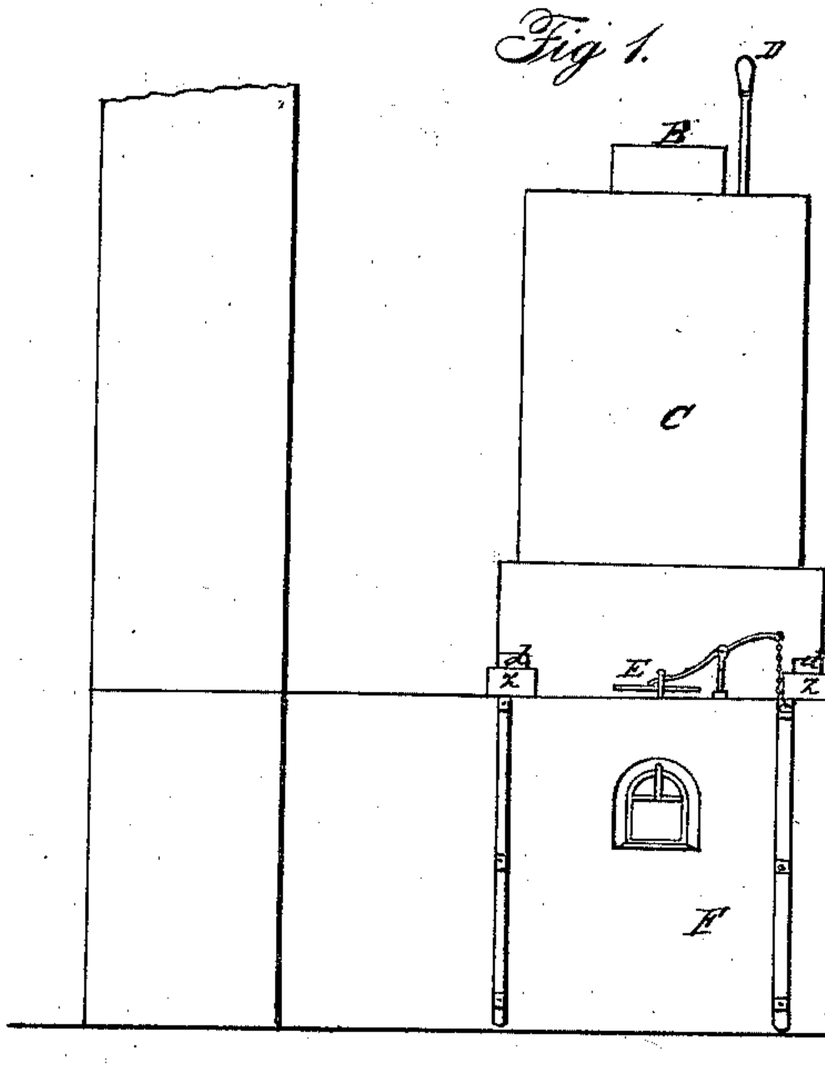


Fig. 4.

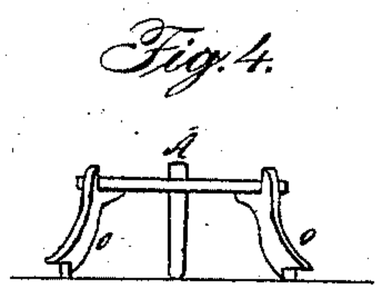
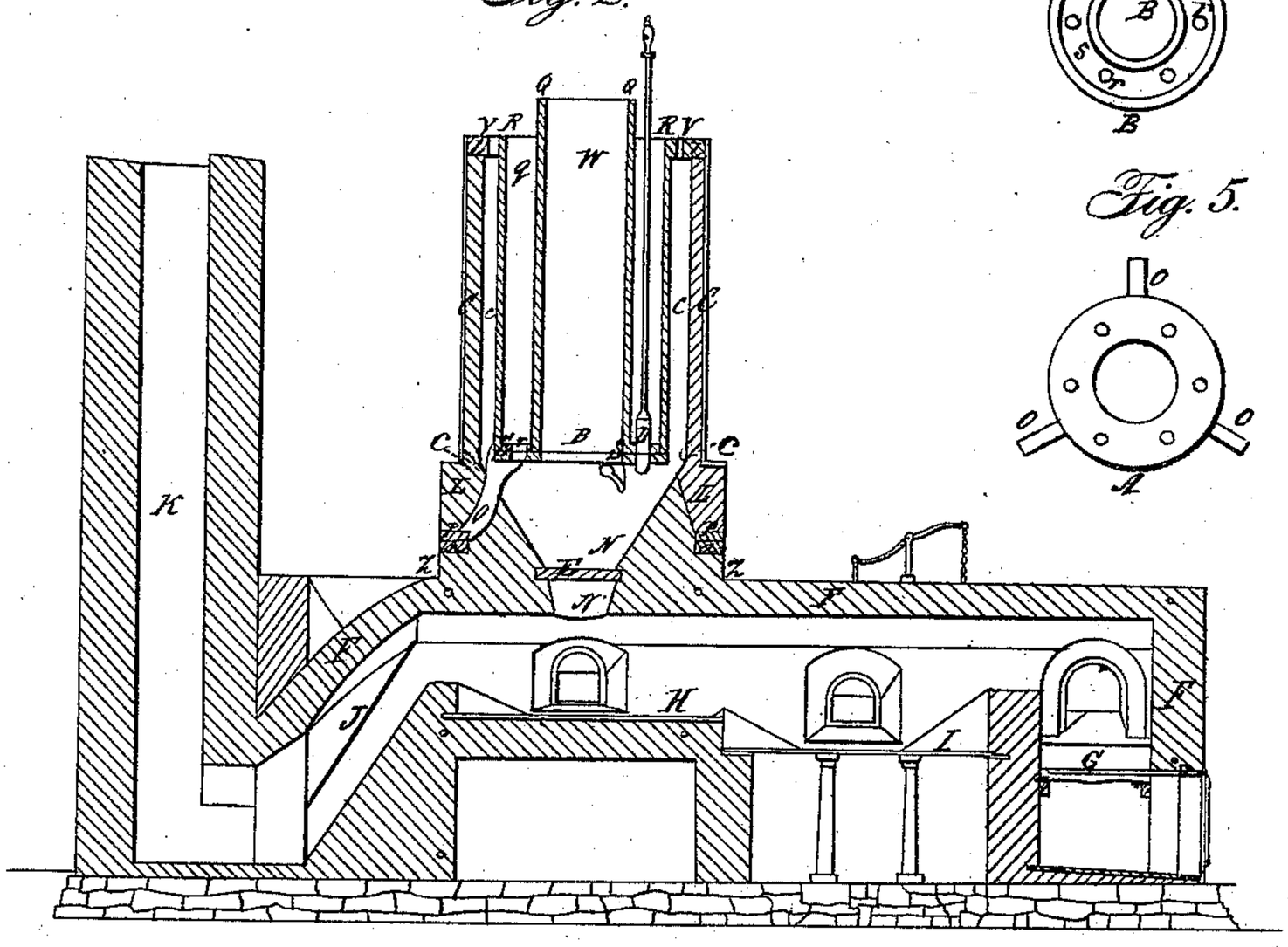


Fig. 3.

Fig. 2.



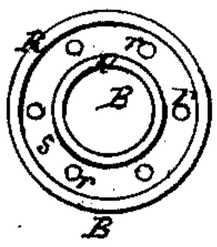


Fig. 5.

UNITED STATES PATENT OFFICE.

ALEXANDER DICKERSON, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN THE METHOD OF MAKING WROUGHT-IRON DIRECTLY FROM THE ORE.

Specification forming part of Letters Patent No. **7,519**, dated July 22, 1850.

To all whom it may concern:

Be it known that I, ALEXANDER DICKERSON, of Newark, Essex county, and State of New Jersey, have invented new and useful improvements in the construction and operation of furnaces for making wrought-iron directly from the ore by the use of anthracite or bituminous coal in place of charcoal; and I do hereby declare the following to be a full, clear, and exact description of the nature, construction, and operation of my invention, reference being had to the annexed drawings, making part of this specification.

First, the distinguishing features of the improvements above referred to are, in substance, as follows: the construction and arrangement, substantially as herein described, of a deoxidizing-furnace consisting of a crucible formed by the union, at bottom, of two concentric or nearly concentric cylinders, or other shaped vessels having free circulation of the hot gases within and around them, so as to appropriate the heat of the gases from the puddling-furnace freely and equally to all parts, while at the same time no portion of the heating-gases or of the atmosphere is permitted to mingle with the ore, except what little of the former may enter during the deposition of a charge or batch, the above being so combined and disposed in connection with a puddling-furnace as that the deoxidized ore may be deposited on the puddling-floor and be converted into balls without having been exposed to the neutralizing contact of the atmosphere at any period of the process, or of its reduction from the ore into balls; secondly, such a form and disposition of the crucible as to insure an even and thorough distribution of the heat, and thereby to avoid the extremes both of excessive and of insufficient heat.

In the annexed drawings the same letters have reference to the same parts throughout.

Figure 1 is an external elevation of the furnace. Fig. 2 is a longitudinal section. Fig. 3 is a plan of the crucible. Fig. 4 is an elevation of the plate supporting the crucible. Fig. 5 is a plan of the same plate.

F is the usual external masonry of a puddling-furnace. G is the fire-chamber. H is the first or reception bottom. I is the puddling-bottom. J is the descending exit-flue. K is the stack.

Immediately over the reception-bottom is the deoxidizing furnace or crucible. This consists of the following parts, to wit: L C is a cylindrical shell of masonry rising from the top of the puddling-furnace directly over the reception-bottom H, but not supported by it, being sustained in the manner following: Z are piers springing from the side walls of the puddling-furnace. On these rest stout cross-bars *d*, which support a heavy ring, P, of cast-iron, which forms the base of not only the superincumbent masonry, but also of the crucible and its appendages hereinafter described. A portion of the cylindrical shell C may be said to consist of a base or pedestal, L, having a circular opening, N′, through the arch of the furnace, which opening N′ widens upward as far as the top of the base L, whence it proceeds upward in a form that is concentric with the cylindrical exterior of the shell C. The mouth of this opening is closable at pleasure by a sliding damper, E. Stout legs O, of stone or iron, embedded in the substance of the pedestal and resting on a ring, P, supported as before described, project inward and upward to afford a support for the crucible.

The crucible B consists of the following parts, to wit: Two hollow cylinders or barrels, Q R, (one of them, Q, somewhat less in diameter than the other, R, and placed concentrically within it,) are united at their lower ends by an annular plate, S, the whole being cast in one piece. Thus is formed between them an annular space or receptacle, *q*, open at top, but closed below, with the exception of apertures *r*, arranged at equal distances around the annular bottom S. These apertures *r* are closed, while the deoxidation is proceeding, with iron plugs D, extending to above the top of the crucible. The interior W of the inner cylinder, Q, is open both at top and bottom, and becomes an avenue for a portion of the hot gases of the puddling-furnace when the damper E is withdrawn. A is an annular plate or disk of cast-iron fitting the bottom S of the crucible B, and pierced with corresponding apertures. The plate A being placed upon the top of the legs O, the crucible is set on the top of it in such a way that the apertures of the two shall correspond. This leaves an annular space, *c*, between the shell C and the cylinder R. This space is closed at top by masonry U, with the exception of small

apertures V, which serve to induce a portion of the hot gases from the puddling-furnace to ascend through the space *c*. The shell C is incased in sheet-iron.

Instead of the plate A, legs O, rings P, and bars *d*, the crucible may be upheld on a hollow water-plate with tubular supporting-bars, said plate having apertures corresponding to those in the crucible.

The mode of operation is as follows: The space *q* in the crucible B being filled with the proper mixture of crushed ore and pulverized anthracite or charcoal, (about fifteen per cent., in weight, of coal,) the coal in the fire-place G is ignited and the slide E drawn out. A portion of the escape heat will pass through the opening N′ in the top of the arch, and through the space W in the center of the crucible, and through the annular space *c*, surrounding the crucible, the outlets of said spaces *c* and W being closed or opened by dampers at pleasure, and will thus cause the crucible to be heated to a red heat, and when the ore in the crucible has become sufficiently deoxidized, (which takes place in from four to six hours, according to the amount of heat applied and nature of the materials,) the plugs D are withdrawn sufficiently to let down upon the first bottom, H, enough of the contents for one batch of puddling, and are then again inserted. The crucible is then replenished with fresh coal and ore at top. The batch of ore so let down is worked on the first bottom, H, until it becomes partially viscid, and is then thrown off into the puddling-bottom I, and then worked into balls. As soon as the first bottom, H, is cleared of one batch, its place is supplied by another, and so the operation continues.

Having thus described my method of making wrought-iron directly from the ore by the use of anthracite or bituminous coal, what I claim as my own invention in the above process for making wrought-iron direct from the ore, and desire to secure by Letters Patent, is—

Deoxidizing the ore in a chamber which is so constructed and arranged as to be heated by the waste heat, and at the same time prevent the product of combustion from coming directly in contact with the ore, (except during the time of charging,) and likewise permits the charge of deoxidized ore to descend upon the puddling-floor or working-bottom without exposure to the atmospheric air, the whole substantially in the manner and by the use of apparatus substantially such as herein described.

In testimony whereof I have hereunto signed my name before two subscribing witnesses.

ALEXANDER DICKERSON.

Witnesses:
WM. P. ELLIOT,
LUND WASHINGTON.