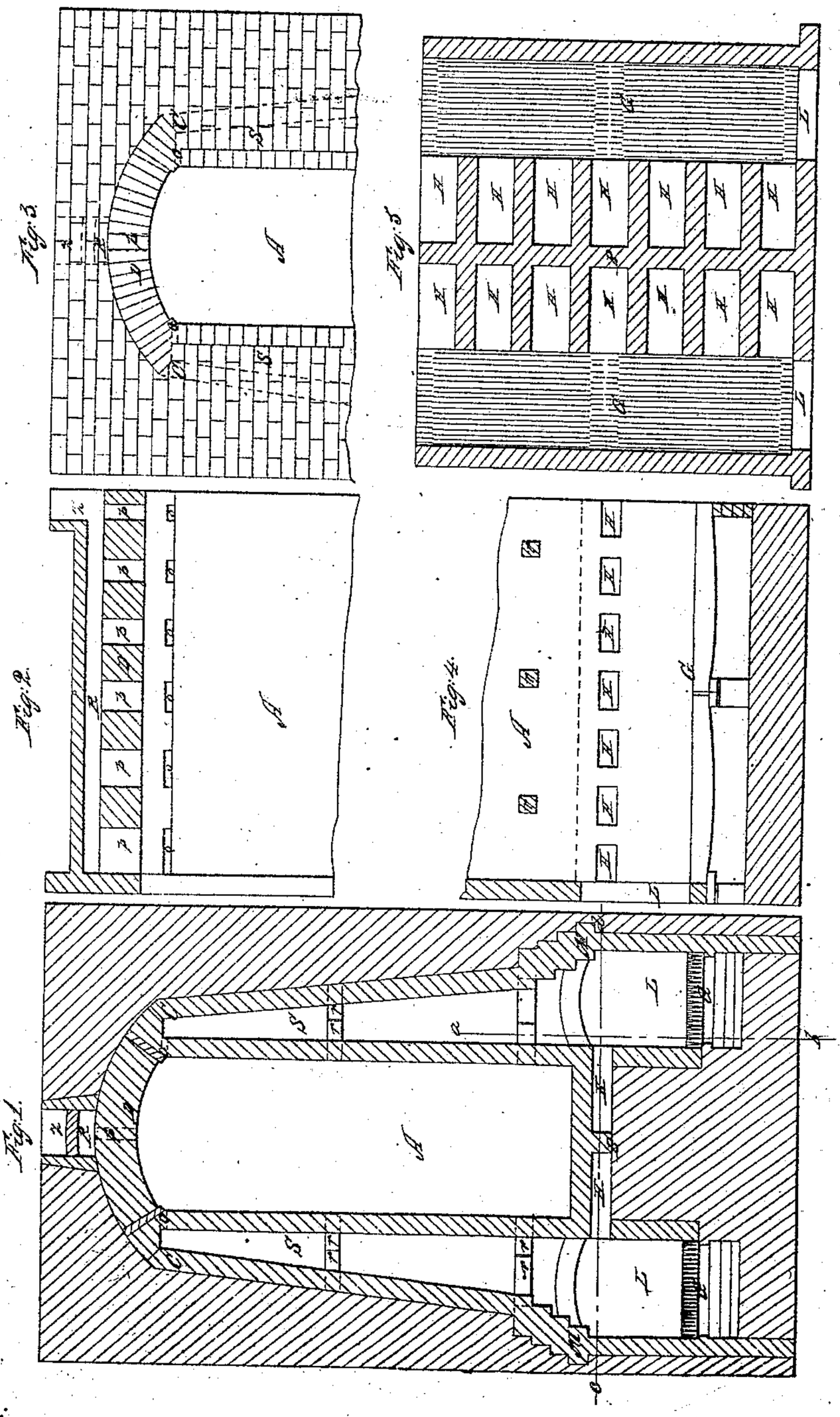
W. A. SWEET.

OVEN FOR CONVERTING IRON INTO STEEL.

No. 45,878. Patented Jan. 10, 1865.



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IMPROVEMENT IN OVENS FOR CONVERTING IRON INTO STEEL.

Specification forming part of Letters Patent No. 46,878, dated January 10, 1865.

To all whom it may concern:

Be it known that I, W. A. SWEET, of the city of Syracuse, county of Onondaga, and State of New York, have invented certain new and useful Improvements in Ovens for Converting Iron into Steel; and the following is such a description of them that any one skilled in such matters may, in connection with the accompanying drawings, which form a part of my specification, readily understand my invention and construct ovens similarly.

The chief object of my invention is to produce a uniform quality of steel throughout the entire mass of iron to be converted—at least, so far as a uniform temperature will give such a a result; secondly, the construction of my ovens is such that their first cost is much less than any other of equal capacity within my knowledge; thirdly, by constructing the converting-chamber with thin walls and carefully distributing and controlling the heat I am enabled to complete the operation in much less time than is usually required; again, the parts are so arranged relatively with each other that all ordinary repairs are easily made without disturbing the external walls or binders; and to illustrate this point more fully I have had the drawings made to represent chiefly the portions that are constructed of fire brick only, leaving the exterior walls to be built according to the pleasure of the constructers.

Figure 1 represents a vertical section through the middle of the oven; Fig. 2, a longitudinal section through the center of the arch and a partial elevation of one side of the converting-chamber. Fig. 3 represents an exterior view of the upper portion of one end of the oven when completed and the arch of fire-brick and the converting-chamber when open. Fig. 4 is a partial plan of one side of the converting-chamber and one side of the heating-furnace, as would be seen through the line *a b*, Fig. 1. Fig. 5 is a section of Fig. 1 through *c d*.

Like letters refer to like parts in all the illustrations, and those parts shaded in blue represent the fire-brick.

The converting-chamber A is formed of fire-brick exclusively, and the bottom and sides are of equal thickness, the bricks in the bottom being set on edge or two thicknesses laid flatwise. The sides are only the thickness of a width of fire-brick, usually about four inches. The form of the chamber is not very important, more than to be convenient for the workmen to enter it with ease. I have made mine that are now in operation large enough to hold from ten to sixteen tons of iron, and they are about three times as high as they are wide and about twice as long as they are high. The bottom of said chamber rests upon two thicknesses of fire-brick, laid, as shown in Fig. 5, in such a manner that openings or spaces H will be formed between the chamber and its foundation, said spaces communicating with the heating-furnaces at both sides, and so that the heat from the furnaces will pass into said spaces or "dead-holes" under the bottom of the chamber. The furnaces and grates *g g* extend along each side of the base supporting the chamber A, and from end to end of the oven, having openings L, also for the admission of fuel, at each end, making thereby four points where fuel is supplied. The longitudinal line of fire-brick, as seen at B, Fig. 5, prevents the draft from passing through from one fire-space or heating-furnace to the other. Consequently the heat produced on one side is confined to that side. The grates *g* are placed just far enough below the dead-holes H underneath the chamber A to give space for the fuel below the holes, so that they may not be filled up thereby, and also that the lower corners of the oven or chamber A will be in close proximity to the heating-furnaces. The sides of the chamber A are raised perpendicularly from the base to the arch D; but the walls C C, Fig. 1, are inclined inward from their base to their top, so as to press the heat, as it rises from the grate, more closely upon the chamber. This contracting of these fire-spaces S S, I find to be of great importance, as it assists in giving an equal temperature along the sides of of the converting-chamber. The arch D, over the chamber A, springs from the outer wall, C C, and covers over the fire-space S S as well as the chamber A. Consequently the walls of the chamber are only built up to the arch, as shown at *o o*, Figs. 1 and 3, but not combined with it. Finding, however, a tendency in the side walls to press in at the top, I have depressed a row of the arch-brick on each side downward, as shown at *o o*, Figs. 1 and 3, so as to form ribs against which the inner edge of the upper course of the chamber-walls can

rest, and thus resist any force which may drive them inward, and yet leave them free from the arch, so that they can be taken down and repaired at pleasure. At the top of the chamber-walls, as at *o*, Figs. 1, 2, and 3, openings are made from the outer fire-spaces S S through said walls into the chamber A, and openings of similar proportions are also formed in the center of the arch D, as at *p*, communicating with a longitudinal flue, R, at the middle of which is the outlet to the chimneys Z. Through said openings the smoke and unabsorbed heat pass off, and the requisite draft for the grates is produced through them.

To stay the sides of the chamber A, I have built in numerous studs of fire-brick in the walls, as at *r r*, Fig. 1, which reach across the fire-spaces and abut against each other, thereby preventing the fire-spaces from closing together from either side, and yet they also serve as reverberators or deflectors of the heat in its ascent from the grates.

I have found by experiment in my last furnaces that the introduction of angular projections or "boshes," as shown at M M, Fig. 1, in the outer walls of the fire-spaces and on a level with the dead-holes H H, &c., formed by putting the brick over the furnaces for three or four courses, and inward to about half the width of the grates, has a most beneficial effect in projecting the heat into the dead-holes or underneath the chamber A, and at the same time they produce a great saving of fuel—at least from one to two tons of coal in a sixteen-ton oven. When the oven is in operation, I observe, on looking in at the furnace-doors L, Figs. 1, 4, and 5, that these boshes impart a rolling or reverberatory action to the flame, and that a more thorough combustion, and consequently a saving of fuel, is produced.

It will be observed at Fig. 2 that the openings *o o o o* and *p p p p*, leading from the fire-spaces to the flue R, are diminished in size from the end of the oven to the center. This constitutes an important feature in my oven, as it causes the heat that would naturally converge to the center to be more evenly distributed along the sides, and produces the same temperature at the ends as in the middle, depending, of course, upon the increase of draft at the ends.

Having thus given, briefly, the points of construction, it may perhaps be added that the iron to be converted is placed in the chamber A in layers, along with the proper substances to make steel, and the mass is raised to within about one foot of the arch D. The ends are then closed with masonry as high or a little above the iron, leaving still small openings underneath the arch. Through these openings I introduce a layer, some five or six inches in depth, of coal ashes and sand, which covers the mass completely and excludes the external air. The holes are then closed and the furnace is ready for "firing" or heating up. The firing is kept up continually for from five to eight days, varying, of course, with the quality and size of the iron and the degree of conversion required. When the operation is completed, the furnace has to cool down before the charge can be removed, and where huge masses of masonry are deemed necessary for strength much time is lost in waiting for the reduction of the temperature, and fuel and time both in raising it; but my method obviates these objections, and since my second charge I have not been able to detect any difference in the degree of the conversion throughout the entire mass, other than is due to the quality of the iron. All parts of the converting-chamber appear to be very evenly heated, and with little waste of time or expense in repairs.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination and arrangement of the heating-furnaces with the converting-chamber A, substantially as described.

2. The dead-holes H, in combination with the heating-furnaces and chamber A.

3. The boshes or angular projections M M, as related to the bottom of the chamber A and the dead-holes H.

4. Gradually diminishing the fire-spaces S S from the boshes M M to the openings *o o o* at the top of the chamber A.

5. The openings, *o o o o o p p p p*, substantially as described, and for the purposes set forth.

6. Supporting the upper edges of the chamber walls from external pressure, substantially as described, and for the purposes set forth.

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