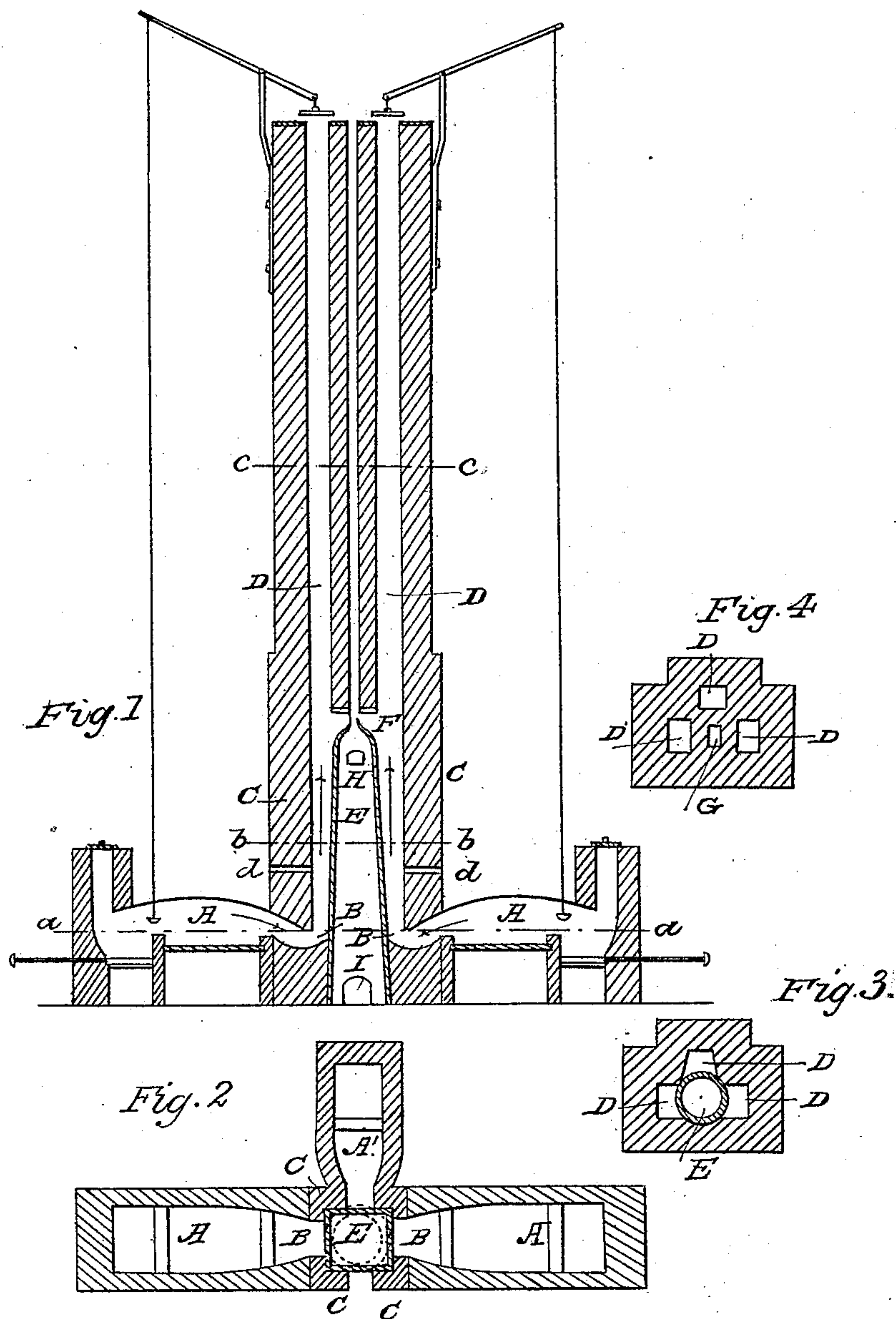


C. S. QUILLIARD.  
Making Iron Direct.

No. 2,394.

Patented Dec. 23, 1841.





# UNITED STATES PATENT OFFICE.

CLAUDE S. QUILLIARD, OF RONDOUT, NEW YORK.

IMPROVEMENT CONSISTING OF A COMBINATION OF FURNACES FOR THE PURPOSE OF MANUFACTURING WROUGHT-IRON DIRECTLY FROM THE ORE.

Specification forming part of Letters Patent No. 2,394, dated December 23, 1841.

*To all whom it may concern:*

Be it known that I, CLAUDE SYLVAIN QUILLIARD, of Rondout, in the county of Ulster and State of New York, have invented a new and useful furnace or combination of furnaces for the purpose of manufacturing wrought or malleable iron directly from the ore without its being first converted into pigs by the operation of smelting; and I do hereby declare that the following is a full and exact description thereof.

The object which I have in view in the construction of my furnaces is to operate upon the rich but refractory ores of iron, which consist, principally, of the protoxides or peroxides of that metal, and contain but little earthy matter, and are fluxed, therefore, with extreme difficulty when subjected to the ordinary smelting process. To reduce these ores and to bring them into the state of wrought-iron, I place the ore, after it has been duly prepared and mixed with a suitable portion of carbonaceous matter, in a crucible or deoxidizing-vessel, either of clay or other refractory substance, in which it is subjected to the degree of heat which is necessary to cause the oxygen of the ore to combine with the carbon, and consequently to leave the iron in the metallic state, the portion of carbonaceous matter mixed with the ore being no more in amount than is necessary to produce this effect, it being intended to avoid, as far as possible, the carbonating of the iron. The crucible or deoxidizing-vessel which I use is placed within or makes a part of a vertical stack or furnace, and it is to be heated by the escape or waste heat of one or more reverberatory furnaces which are combined with it, and are similar in construction to those ordinarily used for remelting, puddling, balling, reheating or other similar processes in the iron manufacture. The heat escaping from these furnaces I conduct into the chimney or stack containing my reducing or deoxidizing crucible in such manner as to preserve the flues of said reverberatory furnaces distinct from each other, and to expose the crucible for the greater part of its height to the action of the heat passing through said flues.

In the accompanying drawings, Figure 1 is a vertical section through the main chimney-stack, through the crucible, and through the two reverberatory furnaces. A A are two re-

verberatory furnaces, which may be constructed in the same way with those now in use, or in the manner of those invented by me, and for which I am about to make application for Letters Patent of the United States, which are intended to be heated by means of anthracite, and to be used without the use of a blast. B B are the flues leading from the furnaces A A into the common chimney-stack C C. The flues D D of these furnaces are carried up separately through the stack, and are provided at top with dampers K K in the usual way. E E is the crucible or receptacle for the prepared ore and carbonaceous matter. This crucible may be formed either of iron, clay, brick, stone, or other refractory material; and it may be round, oval, polygonal, or in any other form deemed most convenient. Although I have denominated the deoxidizing-vessel a "crucible," its office is not the same with that instrument commonly so called, as it is open at its lower end, and is not intended to contain any fused article. At top it has a contracted opening, as shown at F, through which the gaseous matter, liberated from the contained ore and carbonaceous matter, escapes into the small flue G, which ascends the stack separately from the furnace-flues. H represents the place of a door or opening, near the top of the crucible, through which it is to receive its charge of ore, &c., there being a corresponding opening in the stack, furnished with a suitable door or stopper for its introduction. At its bottom there is another similar but larger opening, as at I, for the removal of the deoxidized ore. This opening is guarded by a suitable door or stopper in the same manner with the opening H. Through the stack C C, I also make small openings, as at d d, to which I adapt stoppers. By means of these I am enabled to examine the crucible to see that it is at the proper degree of heat, this being a point of much importance.

Fig. 2 is a plan or horizontal section through my combined furnaces in the line a a of Fig. 1. In this section a third reverberatory furnace, A', is shown, which may be combined with the others and with the stack; or it may consist simply of a fire-chamber for the generating of additional heat, when this may be found requisite. In either case it is furnished with an appropriate flue continued



up the stack in the same manner with those of the furnaces A. A. In this figure the crucible E is represented as round by the dotted lines, and as square by the continuous lines.

Fig. 3 shows a horizontal section in the line *b b* of Fig. 1; and Fig. 2, a similar section in the line *c c*, the respective flues and other parts exhibited in these sections being designated by the same letters as in Fig. 1.

The capacity of the crucible must be determined by that of the other parts of the structure. It should, however, in all cases be such as shall suffice to supply the quantity of deoxidized ore, which can be duly heated or formed into loops or balls in the combined reverberatory furnaces. By proper management the deoxidizing process may be allowed to continue during the night, which will not only have the effect of increasing the quantity of the product, but also of keeping the furnace in a state ready for immediate action in the morning.

The mode of operating with the above-described combined furnaces is as follows: As the ore is to be worked without smelting, it must be carefully selected and prepared for the crucible. The richer and more refractory ores, as above indicated—such as the magnetic black oxide, or protoxide, the purer hematitic ores, or any others of a like character, either anhydrous or hydrated—are to be carefully separated from the gangue or other foreign matter, and, if necessary, moderately roasted to separate the water or other volatile matter. The ore should be broken into fragments, and then separated into lots as equal in size as can be conveniently done. When necessary, it may be washed and otherwise treated in the ordinary way. The ore thus prepared is to be mixed with such quantity of carbonaceous matter as may be necessary for its complete deoxidation, and it will then be ready for the crucible, which is to be charged with it through the door or opening H. When sufficiently acted upon, it is to be removed through the bottom door or opening I, and a corresponding portion fed in at H. The crucible is thus made to operate as a perpetual kiln, and its lower part not being exposed to the direct action of the flame and heat from the reverberatories, the deoxidized iron will be delivered therefrom in a comparatively cool state, so as to be easily managed. It may then be directly passed into the reverberatory furnaces and brought to a welding heat, by which any earthy matters which it may contain will be melted out, and the fusion of these may be aided by the addition of such flux as may be found useful, according to the nature of the ore. As the iron is not to be fused, such addition will not be found requisite with the purer oxides, and in all cases the flux should be sparingly applied. When the iron has acquired a sufficient disposition to agglutinate or unite, it is to be formed into loops or balls preparatory to its being rolled or hammered into blooms, or to its being placed under a

press, for the purpose to be now explained. In this part of the operation, the particles being more fragmentary, and having less tendency to unite than in the ordinary way of preparing loops and balls from pig-iron, I introduce a new mode of effecting the agglutination, and without which they would scarcely bear the action of the rollers or of the hammer, but would be scattered and separated instead of being made to adhere. To produce that degree of adhesion which the action of the hammer or rollers requires, I take the ball loosely agglutinated, or the heated mass without agglutination, from the reverberatory, and I subject it to heavy pressure by means of a screw, lever, hydrostatic, or other press. The ball or heated mass from which it is to be formed may for this purpose be placed in a cylinder or other receptacle, and a follower forced down upon it. This may be readily done by manual or other power, and the mass will be thus brought into a state sufficiently compact for the subsequent operation of the hammers or rollers. It is not necessary, or indeed possible, to prescribe any special manner of effecting this pressure, as all that is necessary is to exert the requisite force upon the mass within a cylinder or other suitable receiver in any of the known ways of effecting this object, and these may be varied according to situation or the preference of the person having the management of the work.

In the press and in the manner of using it I do not claim to have invented anything new, but claim only the employment of such pressure within a cylinder or receiver as constituting a new and improved manner of agglutinating the particles of iron in the operation of forming the blooms preparatory to their being acted upon by the hammer or by rollers.

I have not designated any particular kind of fuel to be used in the foregoing processes, as they may be performed by means of any of those in general use. My intention, however, is to perform the whole of them by means of anthracite, using in this case, as above indicated, my improved reverberatory furnace, for which I am about to apply for Letters Patent, as making a part of the combined furnace or furnaces.

I am aware that puddle balls or loops have been squeezed and worked by means of a vibrating lever upon a flat table; but this is an operation could not be applied to the iron as prepared by me, as instead of agglutinating it would separate its particles, its pressure in a contained vessel being an essential to my process.

Having thus fully described the nature of my combined furnace or furnaces for the manufacturing of wrought-iron directly from the ore, and having also set forth the manner in which I carry the said process into operation, what I claim therein as new, and desire to secure by Letters Patent, is—

1. The combining of one or more reverberatory furnaces with a chimney or stack, containing in its lower part a deoxidizing-vessel,



which I have denominated a "crucible," in such manner that the said crucible and the contained ore and carbonaceous matter shall be heated by the flame and escape heat from the reverberatory furnace or furnaces, by an arrangement and combination of respective parts substantially the same with that herein made known.

2. The manner of agglutinating the mass of deoxidized iron previously heated in the re-

verberatory furnace by submitting the same to pressure within a cylinder or other formed receiver of any suitable construction by means of screw, lever, or other press preparatory to its being acted upon by the hammer or by rollers.

C. S. QUILLIARD.

Witnesses:

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JOSEPH W. WEBB.