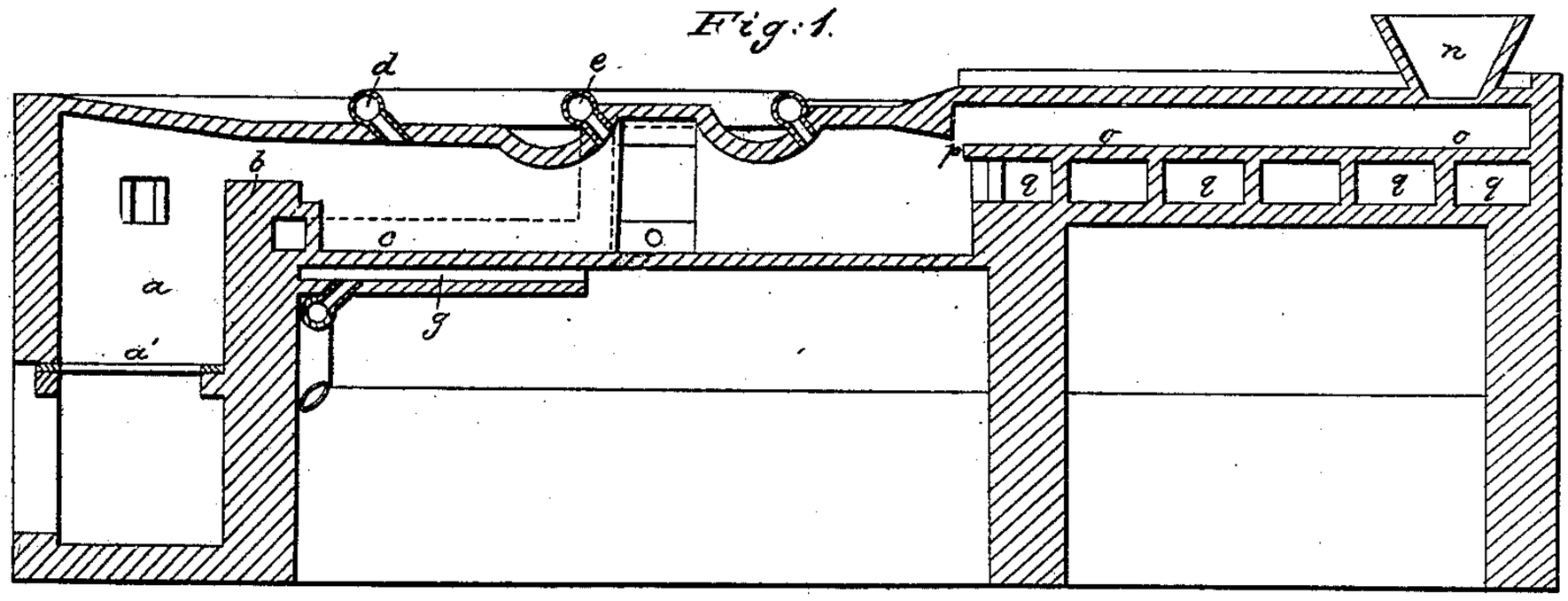
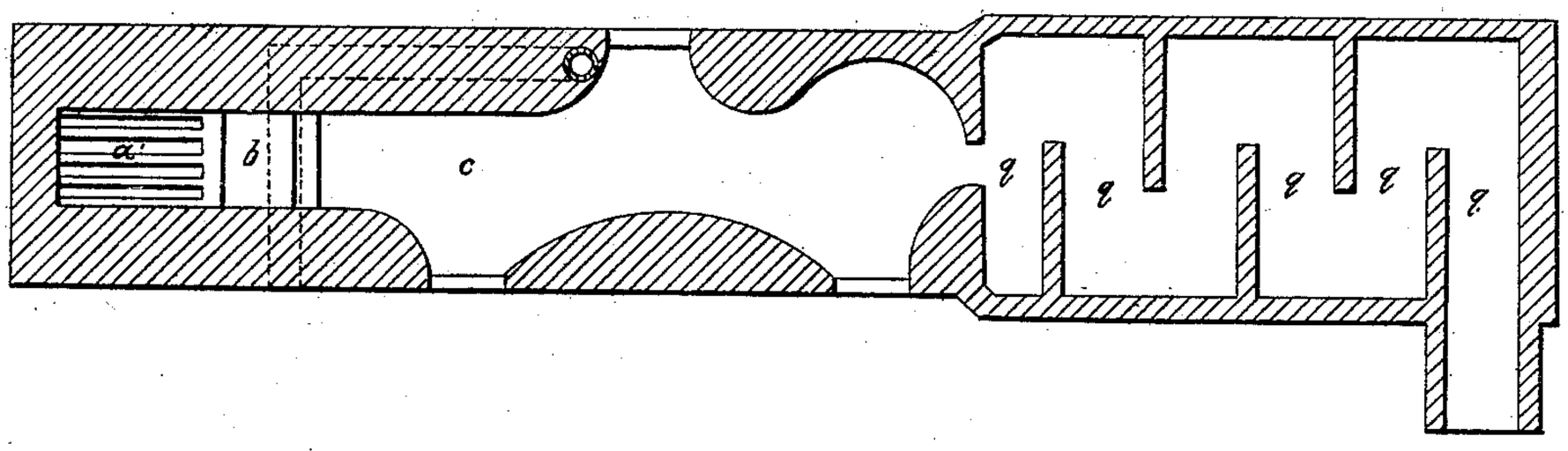
G. A. WHIPPLE.

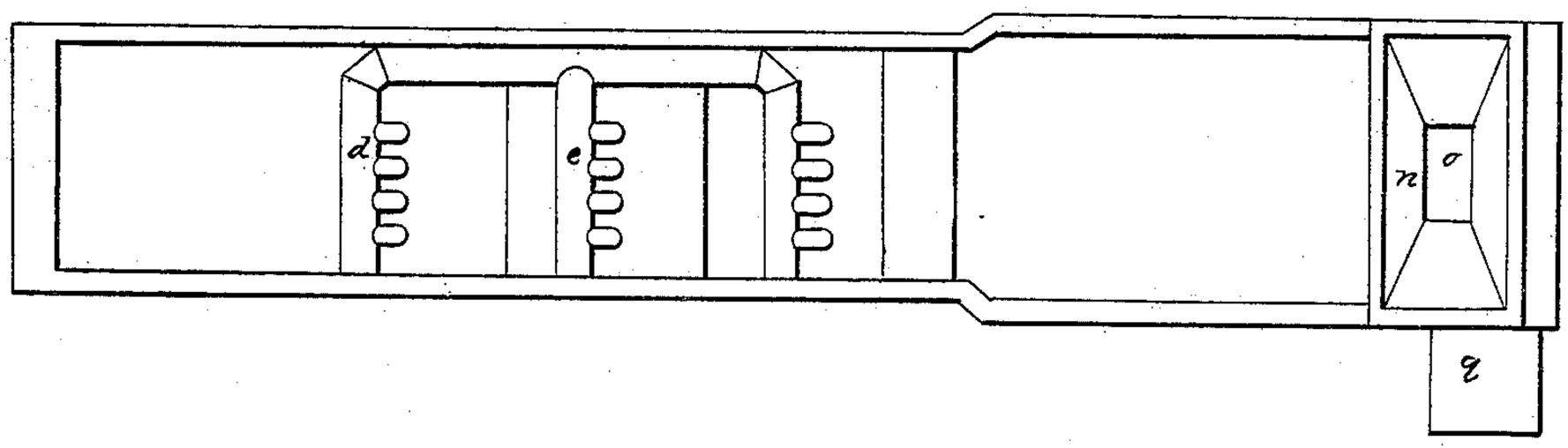
Making Iron Direct.

No. 9,715. Patented May 10, 1853.

Fig. 1.







UNITED STATES PATENT OFFICE.

GEO. A. WHIPPLE, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN MANUFACTURING MALLEABLE IRON DIRECTLY FROM THE ORE.

Specification forming part of Letters Patent No. 9,715, dated May 10, 1853.

To all whom it may concern:

Be it known that I, GEORGE A. WHIPPLE, of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in the Manufacture of Malleable Iron Directly from the Ore; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, illustrating the same.

My invention consists in an improved method of decarbonizing iron ore in manufacturing malleable iron directly therefrom in a reverberating furnace, first subjecting it to the process of deoxidation, by which I bring the ore directly to a pure iron, or comparatively so, rendering it malleable, and preventing either the red or cold shear so troublesome to ironmasters. To effect this I bring a blast of atmospheric air, heated or otherwise, upon the ore, according to the state the ore is in, and the heat required in each process as it progresses to the perfect loop, which drives out the carbon and unites therewith, and also during the process removes the other impurities, destroying or removing the causes that produce red or cold shear in the iron.

In the manufacture of iron of the malleable kinds it is well known that the oxides of which the ore is composed must be treated with carbon to deoxidize it. In the common way this is done in a blast-furnace, by which pig-iron is made, which is then taken to a puddling-furnace, and after the carbon is driven out the iron "comes to nature," as it is called, the impurities are separated, and the pure iron is gathered into a loop, and under a trip-hammer or other analogous device is formed into a "bloom," ready for the market. This is a long and tedious process, involving great expense, so that most of our malleable iron is at this time imported; but by my process I obtain the malleable iron directly from the ore without the intervention of a blast-furnace. This I am aware has been attempted by Dickerson and others, but with so little success and advantage that but for my improvements it would have to be abandoned as an unprofitable manufacture; but with them I have demonstrated by actual practice that I can make a perfect iron with comparatively little expense.

To enable others to construct and use my apparatus, I proceed to describe its details and their application.

I first build a reverberatory furnace, as shown in the drawings, Fig. 1 being a sectional elevation. *a* is a fire-chamber; *a'*, the grate. *b* is a fire-bridge, built of fire-brick, over which the heat and products of combustion pass to the first or balling hearth *c*. Thence it passes over the second and third hearth, and, if necessary, to others beyond, all placed upon the same level or otherwise. Thus far my furnace may be considered like many others, the important difference being that I introduce at one or more of the successive hearths a blast of cold or hot air directly upon the ore in its various stages of progress toward a perfect malleable iron. The mechanical means to effect this may be described as follows, referring to the drawings for illustration: A pipe, *d*, is placed across the top of the arch, from which several short pipes or tuyeres are projected downward through the arch; or the blast may be introduced from pipe *d* through an oblong opening and precipitated in a thin sheet, directed upon the loop or carbonized ore, to produce the effect before indicated. This must not be mistaken for or connected in any way with the devices of W. Von Faber du Faur or others, where a blast of air is introduced to cause a more perfect combustion of fuel, the intention of my device being quite different—namely, to decarbonize the ore, &c., by means of which a very pure malleable iron is produced directly from the ore. Other pipes beside the first, *d*, are introduced just over the second hearth at *e*, producing a second downblast, and a third or more are also added to the extent found requisite, depending somewhat upon the ore and other causes. To heat the blast a pipe may lead from the blower to the blast-pipe *d*, *e*, &c., through the fire-bridge; or it may be heated in any other convenient way. The cold blast is introduced directly from the blower in the common way.

It has been usual to have two doors to the first hearth and the last one opposite each other in the furnace; but they were required to be so far apart to work at conveniently that it was difficult to pass forward the ore and handle it properly. To remedy this defect I

have put but one door only to each hearth, placing them alternately on opposite sides, by which I obtain space for working and a convenient proximity to the ore during the process. This arrangement of the doors is of much greater importance than might at first be supposed. Another device, which may be found important, is to make the hearth hollow, as at *g* in the drawings, causing cold air to pass under it to prevent its burning out, as it is found to do very rapidly under the action of a downblast. This means may be employed at the same time to heat the air used for the blast by connecting it with the blast-pipes in any convenient way.

Having thus described all those parts of the furnace for decarbonizing and their construction, it remains to show their operation.

The pulverized ore, mixed with a due proportion of carbon, according to the kind of ore, as well known, is placed upon a table heated by flues, as hereinafter described, in large quantities, where it remains till wanted. Thence it is let in upon the first hearth, and the process of burning out the carbon from the metal commences, and is carried on as rapidly as is allowable by directing the downward blast—either hot or cold—upon it, regulated by a valve in the ordinary way of blast-pipes. The hot or cold air thus blown down through the burning gases rapidly absorbs the carbon and refines the ore, driving out the impurities. This process is carried on during the progress of the ore to the balling-hearth, the heat upon the ore being gradually increased as the ore is worked forward till it reaches the second hearth, where the process is nearly or quite completed, and the decarbonized ore is brought forward upon the balling-hearth under the blast directed upon it, as before described, from the first pipe, *d*, where the loop is rapidly formed and refined. The processes upon each hearth are of course simultaneous, and the manufacture continuous after it has commenced.

It will be seen by the above that the beautiful doctrine of chemical equivalents has here been perfectly brought into practice, the proper quantity of heat and air being commanded at all times upon the exact point required, and the result is a perfect merchantable iron, made with a quantity of fuel much less than ever before known, and at an expense of time and labor scarcely half that required by the former processes, and much better in quality. The iron ore, after it is pulverized and intimately mixed with carbon, is thrown into a hopper, *n*, at the upper end of a table, *o*, upon which the ore falls, and is spread out to a depth of three or more or less inches. This table *o* is slightly inclined in its position toward the rear hearth, over the rear end of which there is an opening at *p* below the roof the furnace, through which the ore is thrown down onto the hearth where the first process of decarbonizing commences. The table forms the upper side of the flue *q*, leading from the furnace to the stack. This flue is made to run under the table in a zigzag course, so as to impart its heat thereto before entering the stack. This table may be covered with the roof, as shown in the drawings, but should not exclude atmospheric air, and it is always open to the furnace, it not being necessary in my process to exclude the products of combustion, thus giving the greatest facility in manipulating and expedition in the successive operations. After the ore reaches the rear hearth it is worked forward to the balling-hearth, as before clearly set forth. The manipulations on this table are to spread the ore by a firgin or other well-known tool, and to push it down, when in a proper state, onto the first hearth of the reverberatory furnace. When a cold blast is wanted, a pipe leads directly from the blower to the pipes *d* and *e*, &c., above the arch of the furnace. If a hot blast is used, the course of the blast must pass to the pipes *d* and *e* through the bridge-wall or some other heating apparatus. As these devices are obvious and well known to all practical workers in iron, they need no further illustration.

Having thus fully described my improvements in iron manufacture, what I claim therein as new, and desire to secure by Letters Patent, is—

Forcing down upon the iron ore from the roof of the furnace in the different stages of the process, as required, and on the different hearths, atmospheric air, either heated or cold, for the purpose of decarbonizing the ore and bringing the iron to nature or refining the same and regulating the degree of heat, substantially in the manner and for the purpose herein described.

In witness whereof I have hereunto subscribed my name to this my description and specification this 5th day of March, 1883.

GEO. A. WHIPPLE.

Witnesses:

J. J. GREENOUGH,

THOS. E. WARREN.