(No Model.) 2 Sheets—Sheet 1.

J. G. MUSTIN.

ART OF ANNEALING WIRE.

No. 489,194. Patented Jan. 3, 1893.

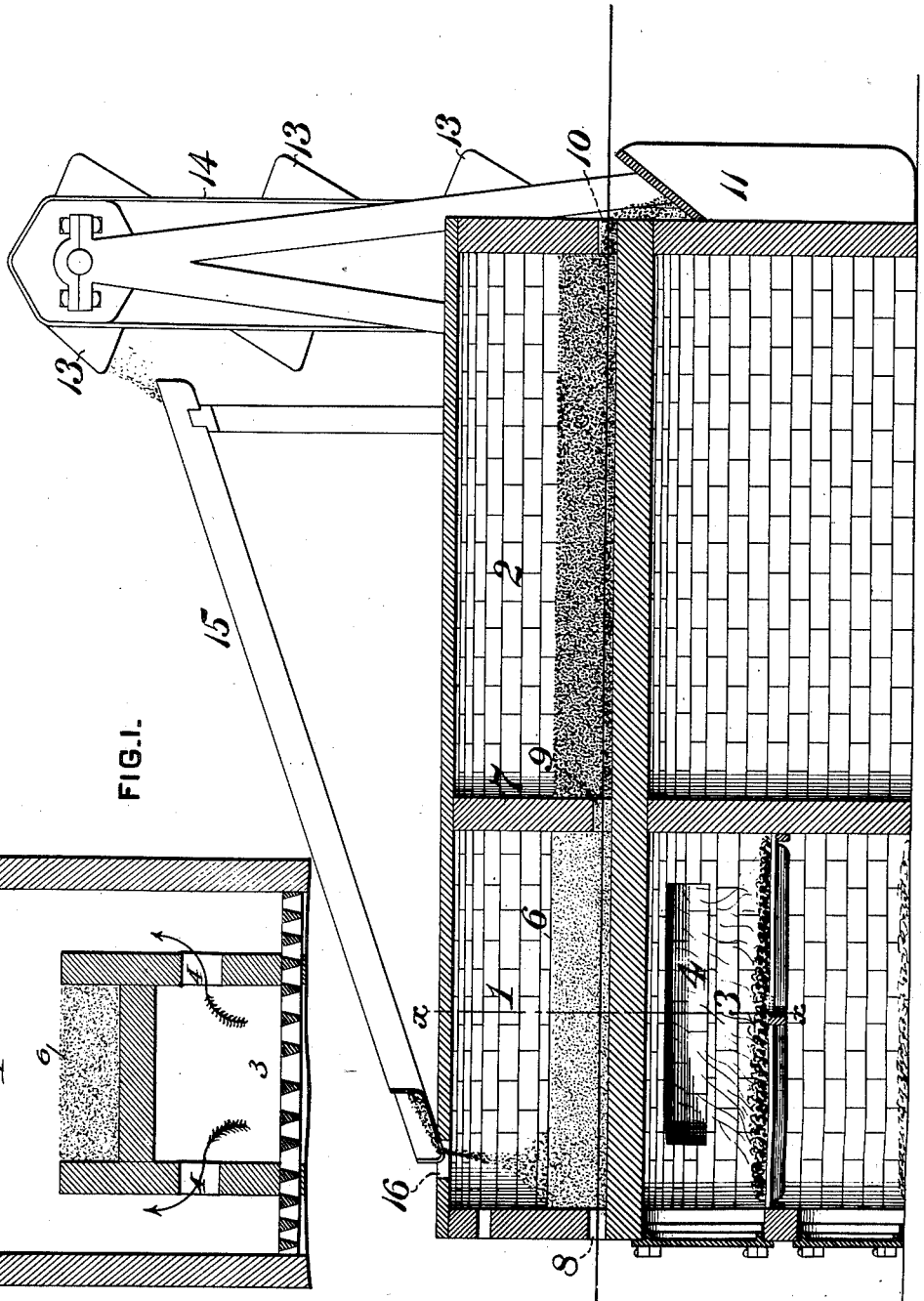

FIG. 1.

Fig. 3.

WITNESSES:

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INVENTOR.

James G. Mustin

by George H. Christy

Att'y.

(No Model.) 2 Sheets—Sheet 2.

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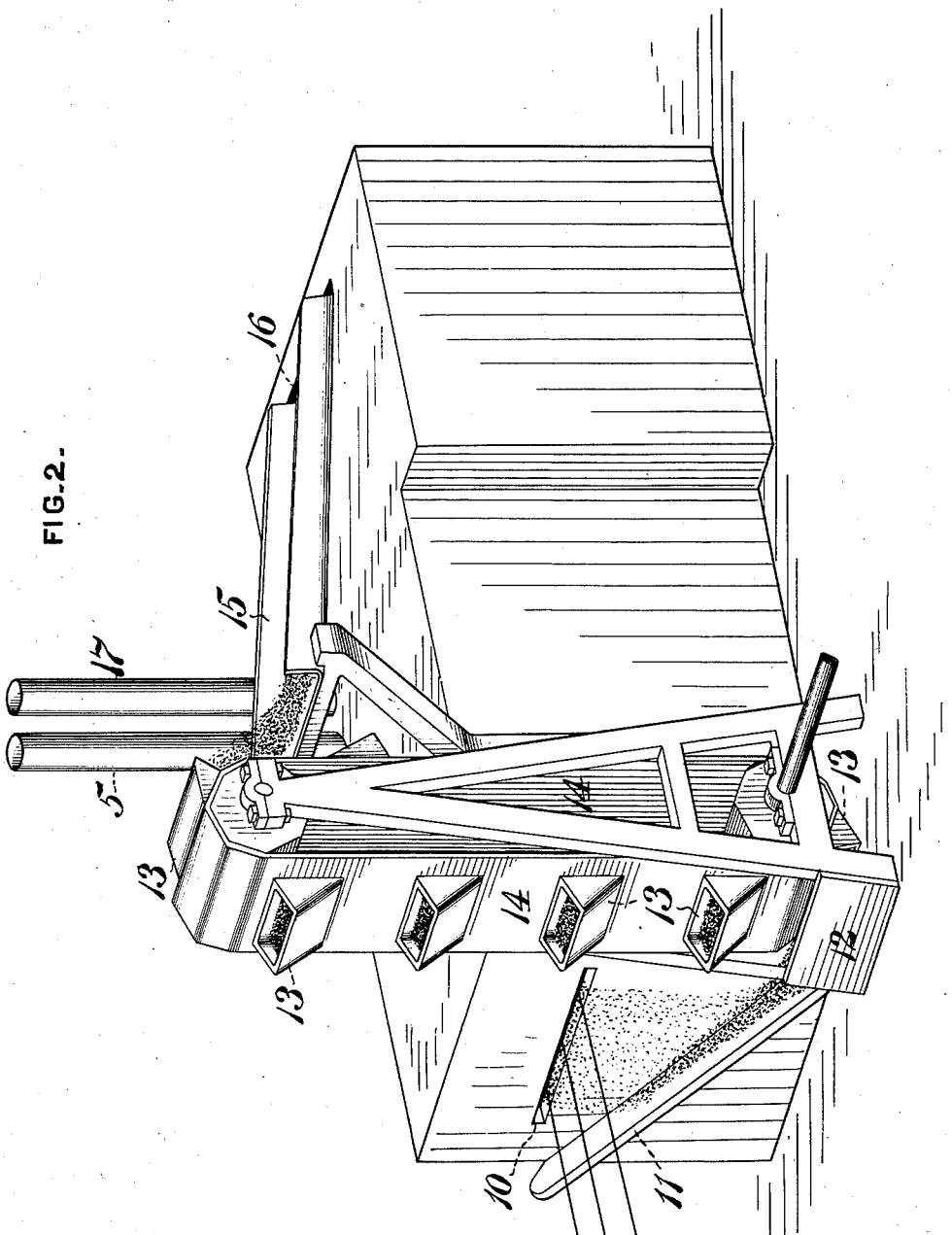
FIG. 2.



WITNESSES:

Dennis S. Wolcott

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INVENTOR,

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UNITED STATES PATENT OFFICE.

JAMES G. MUSTIN, OF KNOXVILLE, PENNSYLVANIA.

ART OF ANNEALING WIRE.

SPECIFICATION forming part of Letters Patent No. 489,194, dated January 3, 1893.

Application filed February 18, 1892. Serial No. 421,947. (No model.)

To all whom it may concern:

Be it known that I, JAMES G. MUSTIN, a citizen of the United States, residing at Knoxville, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in the Art of Annealing Wire, of which improvements the following is a specification.

The invention described herein relates to certain improvements in annealing wire, sheet metal, &c. In working both wire and sheet metal the drawing and rolling operation to which they are subjected so hardens the material as to necessitate a softening or annealing thereof before they can be further reduced or used in the arts. To prevent the scaling of the metal of the wire or sheets during this annealing operation, great expense is incurred. It is well known that when iron or steel is subjected to atmospheric influences when at a high temperature, oxidation is very rapid. To overcome the loss due to oxidation during annealing operations, many devices have been employed, but none, as yet, practically successful.

The object of this invention is to protect the wire or sheet from the inception to the end of the annealing operation, from all access of air, thereby preventing either entirely or to a great extent the oxidation of the surface.

In the accompanying drawings forming a part of this specification, Figure 1 is a sectional elevation of a furnace adapted to the practice of my invention. Fig. 2 is a perspective view of the same, looking toward one of the rear corners, and Fig. 3 is a vertical section on the line *x. x.* Fig. 1.

In the practice of my invention I provide a furnace of suitable construction as regards its length and breadth, in which I form two chambers 1 and 2, the front chamber 1 is arranged immediately over the fire chamber 3, so that the combustion in said chamber will heat the hearth of the heating chamber 1, and the products of combustion passing up through lateral flues 4, will flow over the top of the hearth, and thence to the stack 5, which is so located that the products of combustion will flow uniformly over the top of the hearth of the heating chamber 1. Upon the hearth 1, which is made of a sufficient length to properly heat the articles passing therealong, is placed a body of sand of suitable depth, say five or six inches, to entirely cover either the wire or sheet metal passing through the chamber. The sand is retained at the sides of the hearth by upwardly projecting walls 6, and is prevented from being drawn by the movement of the wire or sheet metal out of the chamber by a partition wall 7. In the front wall of the chamber 1 and also of the partition 7, are formed slots or openings 8 and 9, the opening 9 permitting of the passage of the wire from the chamber 1 to the chamber 2, in which is placed another body of sand designed for the gradual cooling of the wire or sheet metal. The body of sand in the chamber 1 having been properly heated, to annealing temperature the wire or sheet metal is passed in through the opening 8 into the body of sand in the chamber 1, and then drawn along through such body of sand at such a rate as will insure the raising of the wire or sheet metal to the proper temperature *i. e.* about a cherry red. Then the wire or sheet metal passes into the body of sand in the chamber, 2, thence along through such body of sand and out through the opening or slot 10 in the rear wall of the furnace.

It will be readily understood that, although the partition 7 will prevent the access of products of combustion to the chamber 2, yet the portions of the body of sand in said chamber 2 will be considerably heated, and such portions will be further heated by small portions of sand drawn from the chamber 1 by the movement of the wire or sheet metal from one to the other of said chambers. In order to prevent the body of sand in the chamber 2 being too highly heated by radiation from the chamber 1, or by sand drawn from the chamber 1, a stack 17 is arranged at the front end of the chamber 2, so that the heat in the front end of said chamber, passing up through said stack will create a draft of cold air through the opening 10 at the rear end of the chamber 2 and through the sand, which is maintained in a loose, open condition by the passage of the wire, sheet metal &c., whereby the portion of the sand adjacent to the opening 10 in the chamber 2 is maintained at atmospheric temperature. It will be readily

understood that the passage of the wire through these bodies of sand will cause a flow, as it were, of the sand from the front to the rear end of the furnace, and at the rear end the sand will be drawn entirely out of the chamber 2. In order to compensate for this loss of sand and to maintain the beds at a uniform depth, an inclined chute 11, is arranged below the opening 10 in the rear wall of the furnace, which will conduct the sand to a suitable receptacle 12, at one side of the furnace, from which it is drawn up by a suitable arrangement of buckets 13, on a belt or chain 14, and discharged into an inclined chute 15. This chute will conduct the sand to an opening 16 in the top wall of the furnace at or near the front of the chamber 1, thereby maintaining an abundant supply of sand at that point, which will be evenly distributed through the chambers 1 and 2, by the movement of the wires or sheet metal.

It will be readily understood that by highly heating the sand in the chamber 1, all or nearly all the air contained therein will be driven out, and hence, the wire or sheet metal will be protected from atmospheric influences while being heated. It is also true that the air will be driven out of the portions of the sand in the chamber 2 adjacent to the partition 7, such portions being heated as hereinbefore stated, so that the wire will also be protected from atmospheric influences during the initial cooling of the same. It will also be readily understood that the portions of the sand in the chamber 2 will have a temperature approximately that of the sand in the chamber 1, and that such temperature will gradually decrease in proportion to the distance from the partition 7.

I am aware that it is not new to employ a body of sand for heating wire to the desired temperature either by burying coils of such wire in the body of sand, or by drawing it through a suitable body of sand heated by a furnace. But in these several operations the wire is subjected as soon as properly heated to atmospheric influences so that oxidation will occur, or else in the case of burying the coils in the body of sand they are allowed to remain therein until the whole is properly cooled. This, however, is impracticable on account of the long time required to reduce the sand and wire to the proper temperature.

It is characteristic of my invention that the wire or sheet metal is kept in movement constantly during the entire annealing operation, and is protected from atmospheric influences from the time at which it is raised to a sufficient temperature to be easily subject to oxidation until it is cooled to a temperature at which oxidation will cease. It is further characteristic of my invention that the wire or sheet metal is subjected to a continuous operation, that as soon as the wire is drawn from one coil in front of the furnace, its rear end is connected to the end of another coil, thereby permitting of the constant operation of the furnace. It is not necessary that the partition 7 should extend down into the body of sand, but may be so arranged as to prevent the entrance of the products of combustion from the chamber 1 to the chamber 2, so that the two bodies of sand, as they have been heretofore described are practically one continuous body of sand, one portion thereof being highly heated, and the temperature of the remaining portions gradually decreasing until at the rear end the body of sand has a temperature equal or approximately so to the atmosphere.

I am aware that it has been proposed to harden and temper wire for wire cards, by passing the wire after it leaves the hardening bath through a box or trough containing slaked lime heated to a temperature below a red heat or the heat required for the purposes of annealing, dependent upon the temper desired in the finished product, and then through a box or trough containing cold slaked lime, the heating and cooling boxes being separated by a slitted partition to prevent the heat and heated material from passing into the cooling box or trough. This method differs from mine in that the wire is not heated to a sufficient temperature to properly effect the annealing thereof. If in tempering, the wire is heated to a red heat the effect of the previous hardening is entirely destroyed, whereas in annealing it is desirable to heat the wire to at least a cherry red and then gradually cool it down. This difference between tempering and annealing is well known and recognized in the art. The doing of the one does not teach the other.

I claim herein as my invention:

1. As an improvement in the art of annealing wire, sheet metal, &c., the method herein described, which consists in passing the wire or sheet metal through a body of sand having a portion at one end thereof heated, to an annealing temperature, about a cherry red and the temperature of the remaining portion gradually decreasing toward the opposite end whereby the wire or sheet metal passing through such body of sand is highly heated and cooled while protected from atmospheric action, substantially as set forth.

2. As an improvement in the art of annealing wire, sheet metal, &c., the method herein described, which consists in passing wire, sheet metal, &c., through a body of sand, heated to an annealing temperature, about a cherry red and then through another body of sand having a portion thereof approximating the temperature of the highly heated body of sand and gradually decreasing in temperature to that of the atmosphere, substantially as set forth.

3. In an apparatus for annealing wire, sheet metal. &c., the combination of a furnace provided with a heating chamber, a body of sand arranged in the hearth of the heating chamber so as to be subjected to immediate contact of the heat and products of

combustion from the fire chamber of the furnace, which is connected to the heating chamber, and a cooling chamber adjacent to the heating chamber and provided with air inlets and outlets, and a body of sand located in the cooling chamber and arranged so as to be directly subjected to the cooling action of a current of air passing through the cooling chamber, the walls of the heating and cooling chambers having suitable openings for the passage of the wire, &c., into and through the same, substantially as set forth.

4. In an apparatus for annealing wire, sheet metal, &c., the combination of a heating chamber having a body of sand therein, a cooling chamber having a body of sand therein, openings through the walls of said chambers for the passage of wire or sheet metal therethrough, and means for conveying sand from the rear end of the cooling chamber to the front end of the heating chamber, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JAMES G. MUSTIN.

Witnesses:

DARWIN S. WOLCOTT,

CHARLES P. ROBINSON.