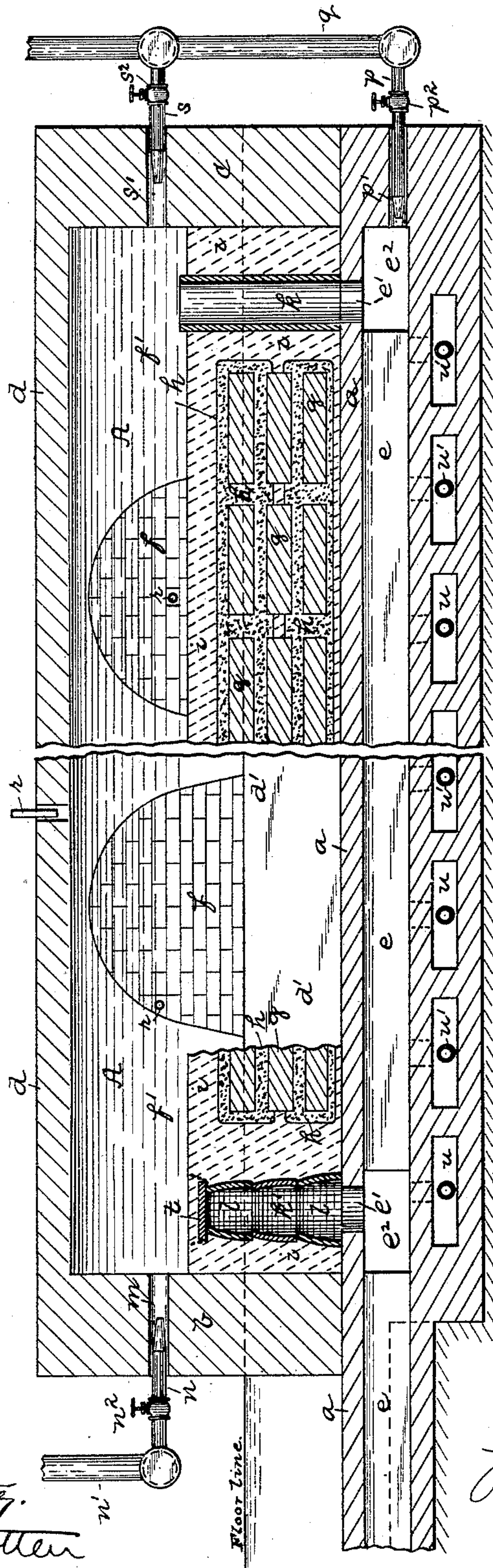


(No Model.)

J. PEDDER.
FURNACE FOR TREATING STEEL.

No. 483,578.

Patented Oct. 4, 1892.



Witnesses:

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UNITED STATES PATENT OFFICE.

JOHN PEDDER, OF PITTSBURG, PENNSYLVANIA.

FURNACE FOR TREATING STEEL.

SPECIFICATION forming part of Letters Patent No. 483,578, dated October 4, 1892.

Application filed April 4, 1891. Serial No. 387,662. (No model.)

To all whom it may concern:

Be it known that I, JOHN PEDDER, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Furnaces for Treating Steel; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to furnaces for treating steel, the invention relating to the same art as the application for patent filed by me March 15, 1890, Serial No. 343,973, the present application relating to certain construction of the flues and other improvements in such furnaces.

In the furnace forming the subject-matter of the said application Serial No. 343,973 the furnace comprised, generally stated, a steel converting or cementation furnace having a hearth to receive the metal, a fire-entrance at the forward end thereof, a downtake-flue leading from the opposite end thereof, and a flue leading therefrom and extending through the hearth below the upper surface thereof and communicating with the chimney-flue, and a gas-entrance communicating with said flue leading through the hearth at the rear end thereof, so as to maintain the heat within the hearth and to obtain the necessary action of the cementation materials upon the metal supported on the hearth, which was heated above by the combustion of the gaseous or other fuel, which then passed through the downtake-flue and thence into the flue extending through the hearth. In cementing or carbonizing or decarbonizing the metals in said furnace it is found absolutely necessary to prevent the contact of air with the steel or metal under treatment, and for this purpose a covering of loam has been found the most practicable. Where, however, the metal is covered and inclosed by this body of loam and the same is supported at the rear end of the furnace by a bridge-wall forming the front wall of the downtake-flue it is found that the expansion and contraction of the metal on the hearth and their covering will act upon this wall in such way as to crack the same and in some cases permit the entrance of air to the metal under treatment, so preventing the proper carbonization or decarbonization thereof and often leading to the burning or de-

struction of the metal, and the present invention has for its object, among other things, the overcoming of this difficulty.

It consists, generally stated, in a steel converting or cementation furnace having a hearth to receive the metal, a fire-entrance at the forward end thereof and communicating with the metal upon the hearth, and one or more tubular downtake-flues near the rear end of the furnace and independent of the rear wall thereof, so as to be surrounded by the loam or other covering of the metal, such downtake flue or flues communicating with the flue extending through the hearth below the upper surface thereof to the forward end of the furnace, it being found that by the employment of such tubular flue, which may be surrounded by the loam or other like material, as the flues are supported by the body of such material entirely surrounding them, the difficulty of the entrance of air through the same into the metal on the hearth is entirely prevented and the injurious action of the expansion and contraction of the metal under treatment is entirely overcome.

It also consists in certain other improvements, as will be hereinafter more particularly set forth.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawing, which illustrates my invention by a longitudinal central section.

The cementation-furnace illustrated has the hearth *a*, the forward end wall *b*, and the rear end wall *c*, and the roof *d*, which is preferably an arch extending up from the hearth or its side wall *d'*, and which may either be formed of removable sections, such as described in said application, Serial No. 343,973, or may have side openings *f* formed at intervals therein, so as to give access to the furnace, it being understood that these furnaces are preferably made of very considerable length and breadth, so as to treat a large charge, one furnace in practical use embodying my invention being about forty feet long and eight feet wide. Extending through the hearth is the return-flue *e*, which leads from the rear end of the furnace to the forward end of the furnace and finally to the stack, the hearth being supported above said return-flue

on a series of longitudinal walls dividing the return-flue into sections, which are connected at the ends by cross-flues e^2 .

The metal to be treated is placed upon the hearth a , the ingots, blooms, or slabs g being surrounded with carburizing or decarburizing material, as at h , while extending under the same and entirely inclosing the charge on the hearth is the loam or like covering i , which, by entirely inclosing the metal for treatment and its carbonizing or decarbonizing material, prevents the access of air thereto and the burning of the treating material, such as where charcoal or bone-black is employed. Near the rear end of the return-flue e is the port e' , extending through the hearth a , and extending above the same is the tubular flue k , there being any desired number of these tubular flues formed near the rear end of the furnace, according to the width thereof, and the flues being adapted to be entirely surrounded by the loam or like covering. I prefer to form these flues of a length of fire-clay or like pipe or tiling, as illustrated, at the rear end of the furnace shown, though they may be formed of any suitable material by which such tubular flue may be built up—such, for example, as a series of crucible bodies, as shown at l at the forward end of the furnace illustrated in the drawing, and for that matter may be built up of brick-work, the essential point of the invention being to provide a flue or flues which are adapted to be entirely surrounded by the loam or like covering in the furnace-chamber, so that the flue will be acted upon on all sides equally by the expansion and contraction of the materials on the hearth. Practical use has proven that by such construction all danger of the cracking or burning of such rear flue in such way as to permit access of air to the metal under treatment is prevented. At the same time the flues can be carried up just above the loam covering, according the height of the charge on the furnace, so that the flame and heated products of combustion can pass close to the top of the loam covering even at the rear end of the furnace and enter into the flues, this being of importance in maintaining the furnace at an even heat, which is necessary for the proper cementation action of the entire charge.

Where gaseous fuel is employed with the furnace, as is illustrated in the drawing, the gas may enter at the forward end of the furnace through suitable ports m in the front wall b and through a series of supply-pipes n , leading from a main supply-pipe n' and controlled by valves n^2 . In the same way the gas may enter through the rear wall c into the return-flue e through a series of ports p' , the supply-pipes p extending from a main supply-pipe q and being controlled by valves p^2 . For the ordinary operation of the furnace these supply-pipes would be sufficient, except where a long furnace is employed, in which

case in order to insure the proper heating of the charge throughout the entire length thereof suitable supply-openings may be formed either in the stationary walls of the furnace or in the walls f' , closing the side entrances f thereof, so as to feed gas to the charge at any suitable point, such gas-entrances being illustrated at r .

For the purposes of maintaining heat within the return-flue throughout the entire length thereof where a long furnace is employed I may also employ a series of cross-flues u , communicating with said return-flue and having gas-entrances u' therein, as shown in said application, Serial No. 343,973, so as to admit the gas and air to such longitudinal return-flue at any point therein, as may be found necessary for the proper treatment of the metal.

For the treatment of the metals under some circumstances where it is desired to act only on one face of heavy slabs, or where in the treatment of the metal it is desired to cut off the heat and consequently stop the action of the cementing materials upon the lower face of the ingots, blooms, or slabs supported on the hearth, it is preferred that the heat and flame shall travel in the opposite direction to that above described, and for this purpose I provide the entrance-flues s' , extending through the rear wall c above the charge on the hearth, into which enter the gas-supply pipes s , leading from the main supply-pipe q and controlled by valves s^2 , and at the same time provide tubular downtake-flues k' near the forward end of the furnace, the downtake-flue in the drawing being illustrated as covered by a block t , inclosed within the loam covering i of the furnace, so that in case it is desired to reverse the current and only act upon the upper surface of the metal this block t may be removed, and by cutting off the gas-supply through the pipes n and p , closing up the ports m and p' , and admitting the gas through the supply-pipe s the flame and heated products will pass over the charge through the fire-space A through the flues k' into return-flue i and thence to the stack.

In the operation of the furnace embodying my invention the ingots or slabs to be subjected to the carbonizing or decarbonizing treatment are placed upon the hearth, it being preferred first to cover the hearth with loam, as at i , and then above the same place the carbonizing or decarbonizing material h , upon which the ingots, blooms, or slabs are placed, the treating materials being filled around the edges as found necessary and the charge being built up in this way until brought to the proper height. Meanwhile the flues k are placed over or built above the port or ports e' at one or both ends of the furnace, and the charge is covered by the loam or like covering, which is also filled in around the tubular flues k , so as to inclose the same in the covering material.

Where removable arched sections are employed, as described in my said application,

Serial No. 343,973, they are placed over the charge, and where removable side entrances are employed, as in the drawing hereunto annexed, the same are built up with brickwork, as at f' , suitable perforated blocks r for the entrance of the gas being built within the same at any suitable point in the length of the furnace, as shown at r , and the furnace being thus completed ready for the cementation operation. The gas and air entering through the ports m form combustion within the chamber A above the charge on the hearth and gradually raise the upper part of said charge and the loam covering over the same to the proper heat, passing to the rear end of the furnace and down through the tubular flues k into the longitudinal flue e and through the hearth to the stack. At the same time the gas entering through the pipes p and the air entering through the ports p' by the combustion of such gas generate a high heat within the return-flue e , so greatly augmenting the heat generated from the gas entering through the supply-pipes n . For ordinary short furnaces this is all that is necessary to cause the even and proper heating of the charge on the hearth. In long furnaces, however, as may be found necessary from the proper testing of the condition of the charge, gas may be fed through the supply-entrances r , either in the side or top wall of the furnace at any suitable point in the length thereof, and the heat in the upper part of the furnace be properly regulated, while the heat in the return-flue e , extending through the hearth, may be regulated in like manner through the air and gas admitted into the cross-flues u' and passing from the same into the return-flues e . By such action the loam covering of the charge will be highly heated and the heat passing through the same will act upon the materials on the hearth, raising them to the proper heat and maintaining a steady heat throughout the charge, which will cause the chemical action of the carbonizing or decarbonizing materials on the metal under treatment, such heat being maintained for a sufficient number of days or hours to cause the gradual carbonization or decarbonization of the charge, and the condition of the metal under treatment being ascertained by suitable test-bars.

Where it is found desirable to discontinue the heat through the hearth a —such, for example, as where heavy ingots, blooms, or slabs are treated within the furnace, and it is desired to subject one face to longer treatment than the other—the gas is cut off from the supply-pipes n and p , the air-ports into which such pipes enter closed, the tiles t , covering the downtake-flues k' , removed, and gas is permitted to enter through the supply-pipes s , when the cementation action may continue, acting upon the upper surface of the metal exposed thereto, and the heat and flame passing through the space or chamber A above the charge and down through the tubular

flues k' and thence to the stack. In like manner where it is desired only to subject one face of the metal to such cementation treatment the furnace may be charged, the one layer or body of steel for treatment being placed upon the same and the gas being fed through the supply-pipes s and passing to the stack through the tubular flues k' , the return-flue e , extending under the hearth, not being employed.

I find that by such furnace I am enabled entirely to prevent the entrance of air to any part of the charge and especially to prevent the entrance of the same through the downtake-flues, as by the employment of such tubular downtake-flues, which are surrounded by the loam or like cover, the flues are acted on evenly by the expansion and contraction of the materials on the hearth, and all fear of the cracking of the same in such way as to permit the opening through the loam covering to the metal under treatment is prevented. In the same manner I provide for the treatment of the metal under any circumstances which can arise, according to the cementation treatment desired.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A cementation-furnace having a hearth to receive the metal, a fuel-entrance at the forward end thereof and communicating with the space above the metal on the hearth, and one or more tubular downtake-flues at the opposite end of the furnace, said tubular flues extending above the hearth, so as to be surrounded by the loam or like covering in which the metal under treatment is inclosed, substantially as and for the purposes set forth.

2. A steel converting or cementation furnace having a hearth to receive the metal, a fuel-entrance at the forward end thereof and communicating with the space above the metal on the hearth, one or more tubular downtake-flues leading from the space above the hearth down to a stack-flue extending along through the hearth to the forward end of the furnace, said tubular flues extending above the hearth, so as to be surrounded by the loam or like covering of the charge, and a fuel-entrance communicating with said return-flue at the rear end of the furnace, substantially as and for the purposes set forth.

3. A steel-cementation furnace having a hearth to receive the metal, front and rear end walls, both said walls having fuel-entrances communicating with the space above the metal on the hearth, a return-flue extending longitudinally through the hearth and close to the upper surface thereof and opening at one end into the discharge-flue, downtake-flues at or near both ends of said furnace-chamber, opening at the upper end into the furnace-chamber and at their lower ends into the return-flue, and a cover for closing the downtake-flue not in use, substantially as and for the purposes set forth.

4. A steel converting or cementation furnace having a hearth to receive the metal, front and rear end walls, and an arched side and top wall extending over said hearth
5 and having side entrances therein, which are removably closed by brickwork during the treatment of the metal, and gas-entrances formed in the brickwork, closing such side

entrances, substantially as and for the purposes set forth. 10

In testimony whereof I, the said JOHN PEDDER, have hereunto set my hand.

JOHN PEDDER.

Witnesses:

ROBT. D. TOTTEN,
J. N. COOKE.