

No. 757,276.

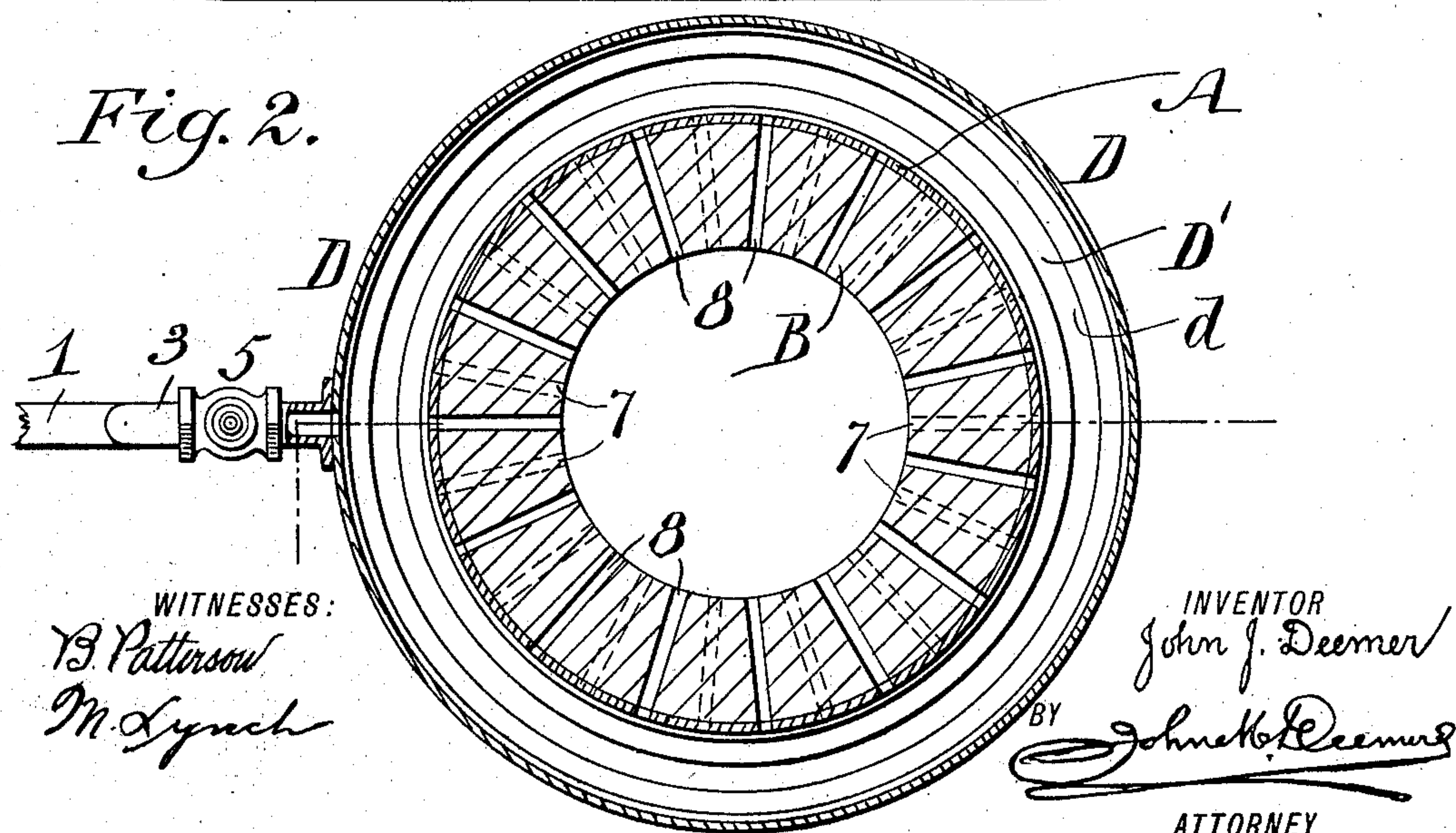
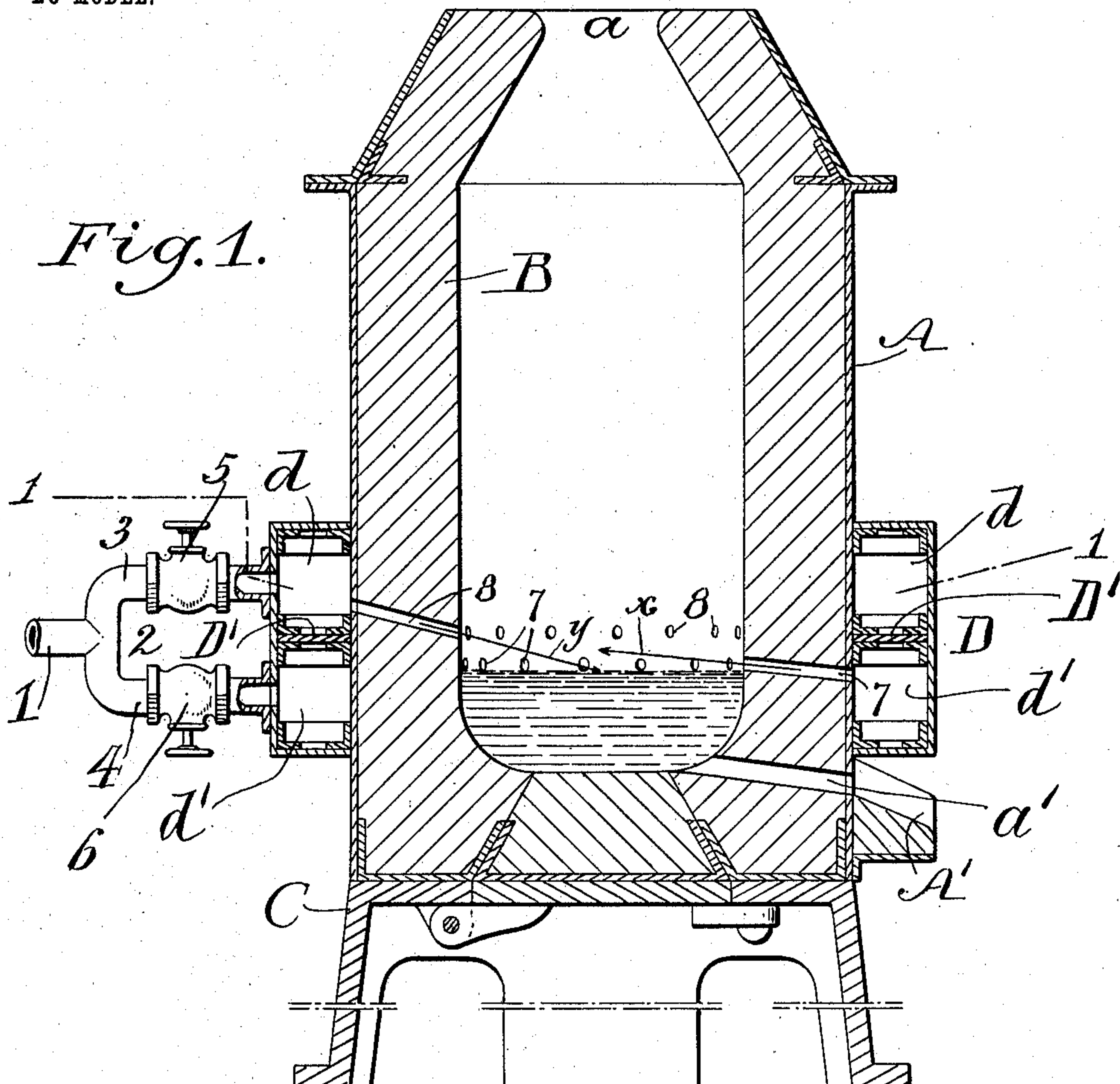
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J. J. DEEMER.

PROCESS OF CONVERTING CRUDE IRON INTO MALLEABLE IRON OR STEEL.

APPLICATION FILED FEB. 9, 1903.

NO MODEL.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

JOHN JOSEPH DEEMER, OF CHESTER, PENNSYLVANIA.

PROCESS OF CONVERTING CRUDE IRON INTO MALLEABLE IRON OR STEEL.

SPECIFICATION forming part of Letters Patent No. 757,276, dated April 12, 1904.

Application filed February 9, 1903. Serial No. 142,510. (No specimens.)

*To all whom it may concern:*

Be it known that I, JOHN JOSEPH DEEMER, a citizen of the United States, and a resident of Chester, county of Delaware, and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Converting Crude Iron into Malleable Iron or Steel, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof, in which similar characters of reference indicate corresponding parts.

This invention relates to that mode of converting crude iron into malleable iron or steel for the production of steel castings or ingot iron in which molten metal is agitated and atomized in the presence of a converting agent, in which process limited portions of the body of molten metal are successively violently agitated by a converting blast of aeriform oxidizing agent, as air.

In the conversion of crude or pig iron into malleable iron or steel the oxidizing agent is employed for the purpose of eliminating carbon, silicon, and other elements held in combination with the iron and it is essential that the oxidizing agent shall come in contact with the iron and be distributed thereto in such a manner as to insure oxidation of all the combustible elements without liability of having the eliminated impurities again enter into the body of the metal. It is also of great importance that the manner of bringing the air and iron in contact be such that the said elements shall be thoroughly oxidized and the air deoxidized to as great an extent as possible. Further, it is requisite to maintain a high temperature and bring the metal to an extremely fluid condition without the use of any other fuel than that afforded by the combustible elements of the iron.

The object of this invention is to rapidly and effectively oxidize and eliminate the impurities in such a manner that they will not be subject to liability of being forced back into the body of metal after elimination and that when eliminated they shall remain as far as possible in a quiescent state on the surface

of the bath, whereby an exceedingly pure quality of metal is produced.

Further objects are to maintain a high temperature and rapidly convert and bring a maximum quantity of metal to an extremely fluid condition by employment of a minimum of pressure for the converting agent.

These objects are attained in my improved process by use of a stationary converter which is of large diameter and of greater capacity than the pivotal converters now in general use in pneumatic processes of converting iron into steel and an evenly-distributed air-blast which is introduced through annular series of twyers, the air being supplied under considerably less pressure than is generally required in converting processes where air is employed as an oxidizing agent. Thus I greatly reduce the cost of production and am able to produce a large quantity of converted metal highly heated in an extremely fluid condition and susceptible of being taken from the converter in desirable quantities either for the production of castings or ingots.

It has been found that the most impure steel manufactured by the pneumatic process is that produced from a body of metal which has been subjected to considerable gyrating, churning, and stirring during process of conversion. In my process the surface only of the bath is agitated and subjected to violent atomic action, the body of metal being maintained during conversion in a comparatively quiescent state and not gyrated at all. Therefore I produce a very pure quality of converted product.

In the accompanying drawings, forming part of this specification, I have illustrated a converter adapted for carrying out my invention, in which—

Figure 1 is a vertical sectional elevation, and Fig. 2 a sectional plan view taken on the line 1 1 of Fig. 1.

The converter comprises a shell A, composed of metallic sheets suitably strengthened by angle-iron ribs, as in similar constructions. This shell is cylindrical in form, having a conical top or dome terminating in an opening



$\alpha$ , through which molten metal may be charged and by which gases are discharged during the process of decarburization. The inside of the shell is lined with refractory material B of any suitable thickness and composition. The converter is mounted in stationary position, preferably upon a suitable base, as C, and it is provided with a downwardly-extended discharge-channel  $\alpha'$ , through which the converted metal is teemed out and which may be closed by means of a suitable plug during the process of conversion. This channel empties into a spout or trough A', adapted to empty the metal into a ladle or other receptacle.

Surrounding the converter is an annular air-chest D, which embodies two continuous compartments  $d$   $d'$ , separated by means of an endless horizontal partition D'. This chest is composed of sheet metal suitably strengthened by angle-iron rings.

Leading to the air-chest D from a blowing-engine of suitable capacity is a supply-pipe 1, having a bifurcated outlet 2, embodying the branches 3 and 4, leading, respectively, into the compartments  $d$  and  $d'$  of the air-chest D. These branches are respectively provided with valves 5 and 6, whereby the compartments of the air-chest may be simultaneously or alternately provided with a supply of air.

Two rows of twyers 7 8, arranged in annular series, are extended from the compartments  $d$   $d'$  into the converter, the lower row being extended inwardly at a slight upward angle, having their discharge ends on a level with the normal surface of the bath when the converter is charged, but the converging point above the surface level of said bath, as indicated by the arrow  $x$ , and the upper row being extended downwardly and inwardly at an angle, having their discharge ends above the normal surface of the bath, but the point or convergence on a level with the bath-surface, as indicated by the arrow  $y$ . Each row of twyers converges at a common vertical center—namely, the vertical axis of the converter—whereby when the air is applied the blast from each twyer of a row meets at a common central point and causes atomic action and agitation only upon the bath-surface, and the eliminated scoria, owing to its comparatively light specific gravity, remains upon the surface of the bath, whereby liability of having the eliminated impurities forced back into the body of the metal is obviated.

When the charge of iron previously melted in an ordinary cupola or other furnace has been run into the converter, I open the valve 5 and close the valve 6, thus starting the operation with the upper series of twyers. When the blow has gone on for a short time and the iron has been raised to a temperature above its initial condition or until the effervescing or boiling period, when the more

oxidizable silicon is affected and a grayish or whitish kind of smoke is emitted from the converter, I shut off the valve 5 and continue the operation by opening the valve 6, thereby supplying a blast through the lower set of twyers, which having a slight upward direction will allow the blow to be finished with the bath as quiet as possible. The air being compressed at a low pressure has not sufficient force to enter the bath, but only acts upon the surface thereof, and the symmetrical arrangement of the twyers all pointing to a common vertical center and having the greatest pressure at their mouths prevents the slag from obstructing them. During the said first period considerable slag is formed; but as said slag is maintained upon the surface of the bath and by reason of the blast from the twyers coming in direct contact therewith highly heated and very fluid it becomes a reacting agent to increase the temperature of the body of the bath and assist further elimination of impurities by transmission of heat through the molecules successively from the top to the bottom of the metal. When the surface of the bath is somewhat lowered by elimination of the impurities, the blast from the lower series of twyers still further raises the temperature and disintegrates and oxidizes the remaining impurities by transmission of heat to the scoria and through the body of the bath. Thus I accomplish the conversion of a large quantity of metal by means of blasts from twyers directed to converge at a common vertical center, but at different levels relative to the bath-surface, whereby a large stationary converter is successfully employed and gyrations of the body of the metal, which are common to all methods where pivotal converters and twyers directed from one side of the converter are employed, are entirely prevented.

I do not limit myself to the employment of means and apparatus hereinbefore described, as it is obvious that under the scope of my invention I am entitled to variations.

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

1. In the conversion of molten crude or cast iron into malleable iron or steel, subjecting the bath of molten metal to the action of oxidizing-blasts directed over the surface area of the bath by means of an annular series of jets extending upwardly and obliquely and converging at a common point centrally above the bath-surface, substantially as shown and described.

2. In the conversion of molten crude or cast iron into malleable iron or steel first subjecting the bath of molten metal to the action of oxidizing-blasts directed against the surface area of the bath by means of an annular series



of jets extending downwardly and obliquely,  
and converging at a common point centrally  
on the bath-surface, and then subjecting the  
bath to oxidizing-blasts by means of an an-  
5 nular series of jets extending upwardly and  
obliquely and converging at a common point  
centrally above the bath-surface, substantially  
as shown and described.

In testimony that I claim the foregoing as  
my invention I have signed my name, in pres- 10  
ence of two witnesses, this 16th day of Janu-  
ary, 1903.

JOHN JOSEPH DEEMER.

Witnesses:

OLIVER BORTH DICKINSON,  
WILLIAM JAMES FENNELL.