

(No Model.)

G. L. ROBERT.

PROCESS OF CONVERTING CRUDE IRON INTO MALLEABLE IRON OR STEEL.

No. 395,633.

Patented Jan. 1, 1889.

Fig. 2.

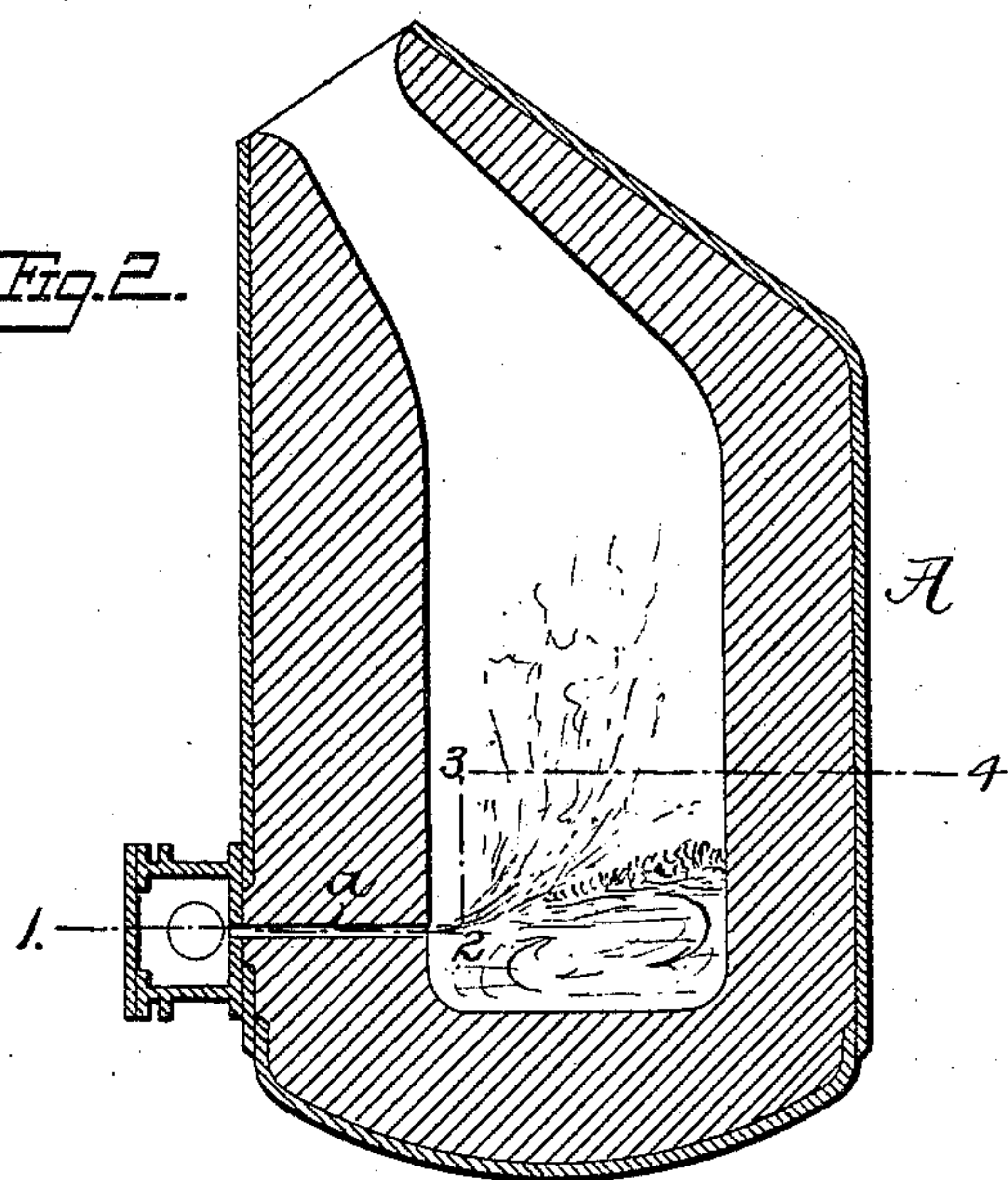


Fig. 1.

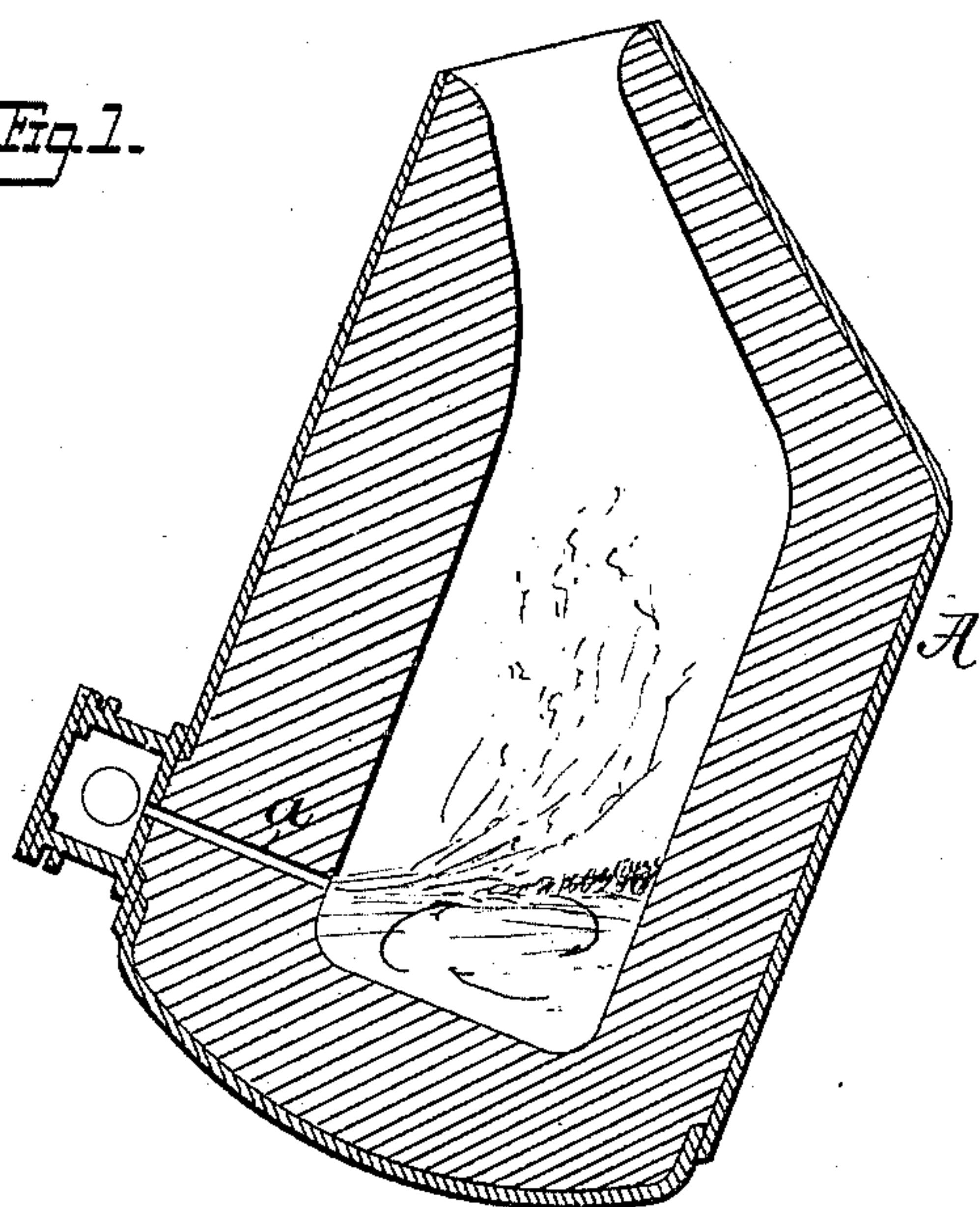
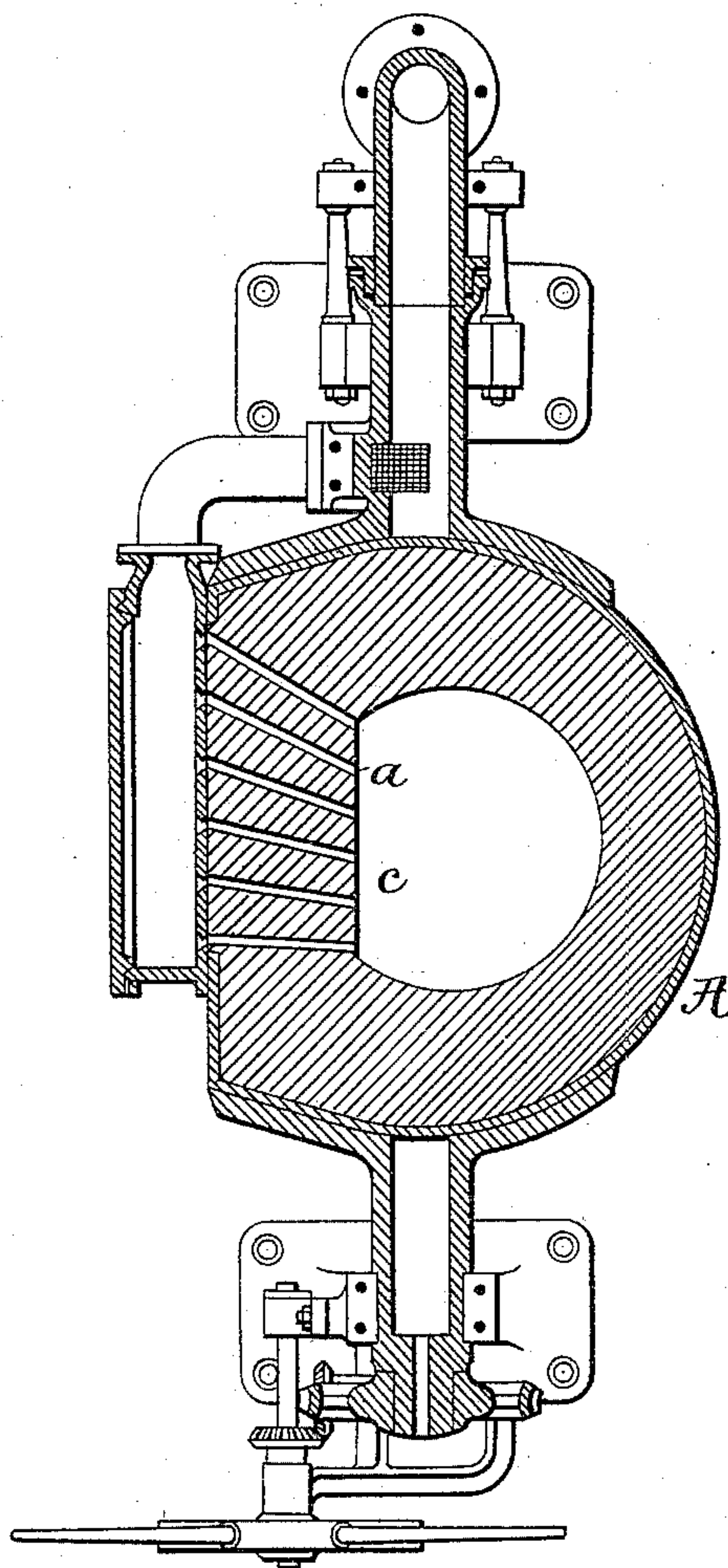


Fig. 3.



Witnesses.

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# UNITED STATES PATENT OFFICE.

GUSTAVE L. ROBERT, OF STENAY, FRANCE, ASSIGNOR TO JOHN WESLEY BOOKWALTER, OF SPRINGFIELD, OHIO.

## PROCESS OF CONVERTING CRUDE IRON INTO MALLEABLE IRON OR STEEL.

SPECIFICATION forming part of Letters Patent No. 395,633, dated January 1, 1889.

Application filed November 19, 1888. Serial No. 291,190. (No model.) Patented in England May 9, 1888, No. 6,886.

*To all whom it may concern:*

Be it known that I, GUSTAVE LOUIS ROBERT, a citizen of the Republic of France, residing at Stenay, Department of the Meuse, Republic of France, have invented a new and useful Improvement in the Process of Converting Crude Iron into Malleable Iron or Steel, (patented in Great Britain May 9, 1888, No. 6,886,) of which the following is a full, clear, and exact specification.

This invention relates to that process of converting crude iron into malleable iron and steel set forth in my application for Letters Patent, Serial No. 290,776, in which process limited portions of a body of molten metal are successively violently agitated to spray or atomize such portions and separate the metal and the impurities, while the main body of material is not so acted upon, but supports the separated impurities in a comparatively quiescent state.

For the purpose of imparting the desired violent agitation to limited portions of the metal, I have made use of a blast of air which impinges upon a limited portion of the metal at one time and strips the same from the main body, finely atomizes or divides the whole or the greater part of the portion acted upon, and projects it toward one side of the converter in the presence of the converting agent—for instance, of the oxygen of the air-blast.

Inasmuch as the blast acts with the aforesaid stripping action upon only a limited portion of the metal at a time, it is necessary to provide some means for bringing every portion of the bath repeatedly within the area of violent agitation and conversion, and I have devised means whereby this may be effected by the action of the blast itself, as herein-after fully described.

For the purpose of illustrating my invention I have shown an apparatus by means of which it may be carried out, Figure 1 being an elevation of a tilting converter illustrating its position at the beginning of the process; Fig. 2, an elevation of the converter in the position occupied later in the process, and Fig. 3 a sectional plan on the line 1 2 3 4, Fig. 2.

A is the body of the converter, and at one

side of the same and extending around only a portion of its circumference I place a series of tuyeres, *a*, so arranged that they will form at their inner ends a straight line parallel with the axis of the converter and also parallel with the natural surface of the metal in the converter. The tuyeres are so arranged or the converter is so tilted that the blast will be delivered at a point adjacent to the natural level of the metal in such manner as to strip off a portion only of the metal at a time and project the same in finely-divided particles toward the opposite side of the converter. The blast thus impinging upon the body of metal at a part only of the periphery or outer face of the same not only strips off the limited portion of metal with which it immediately contacts, but also acts mechanically to overcome the inertia of the mass and impart thereto a gyrating motion in the direction of the arrows, Fig. 1, that brings every portion of the bath repeatedly within the area of violent agitation without so agitating the main body or imparting thereto vortices or currents that would carry the scoria back into the mass. I also incline the tuyeres so that the air will enter in a direction at a tangent to the inner periphery of the converter. The tuyeres being thus arranged in a straight line and horizontal plane, when a charge is converted, by tilting the converter the metal is caused to leave the mouths of all the tuyeres simultaneously, and the operator may at once bring the air-blast to any desired angle or to any desired depth below the normal surface of the metal during the process of conversion simply by inclining the converter to the required angle, and thus regulate at will and with precision the necessary quantity of metal presented to the blast and establish that delicate relation of the quantity of air and metal, as well as other relative conditions, which experience quickly points out as indispensable in producing the best results, whatever may be the nature or quality of the crude metal operated upon.

In order to impart a horizontal circulation to the metal the blast is directed on converging lines toward one side of the converter, so as to act mainly upon the metal at one side of the vertical axis of the converter, and thus



there is given to the metal a rotary motion about the vertical axis of the converter. The force of the air-blast draws the metal from the bottom upward, and as it is forced across  
5 and accumulates at a higher level on the opposite side of the converter, as shown in Fig. 2, there is formed at that point a tendency of the metal to flow downward. From these two causes a quick vertical rotary motion is in-  
10 duced. The union of this more rapid vertical with the slower horizontal motion imparts to the whole mass of metal a spiral rotary motion, which insures a complete circulation in the entire body of the metal that  
15 will bring with certainty and requisite speed every particle of metal to the mouth of the tuyeres—a process that is repeated until every atom of iron has received its due quantum of oxygen and the impurities are all separated.  
20 By imparting this uniform, regular, and relatively slow rotary motion to the metal *en masse* there are however no violent currents induced having the effect to draw the scoria and other impurities down into the metal, but

it will thus be left to remain floating on the 25 surface.

I do not claim the apparatus illustrated, as the same constitutes the subject of a separate application for Letters Patent, Serial No. 248,578.

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I claim—

In the conversion of molten cast or crude iron into malleable iron or steel, the mode, substantially as hereinbefore described, consisting in applying the air-blast to a portion  
35 only of the molten metal at the surface of the bath and directing the blast toward one side of the mass, creating thereby a gyrating circulation of the metal, substantially as described.

40

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAVE L. ROBERT.

Witnesses:

J. S. BARKER,  
F. L. FREEMAN.