

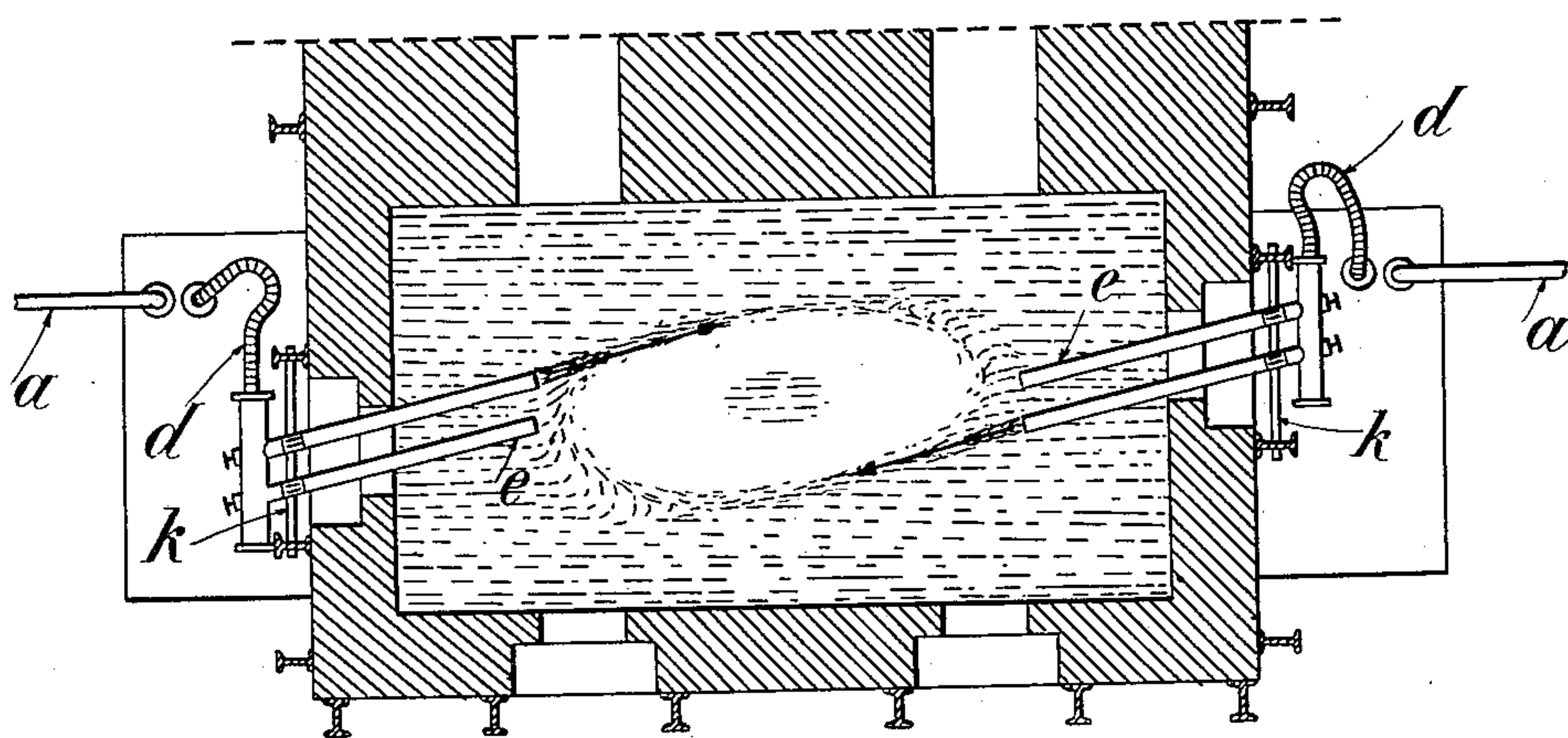
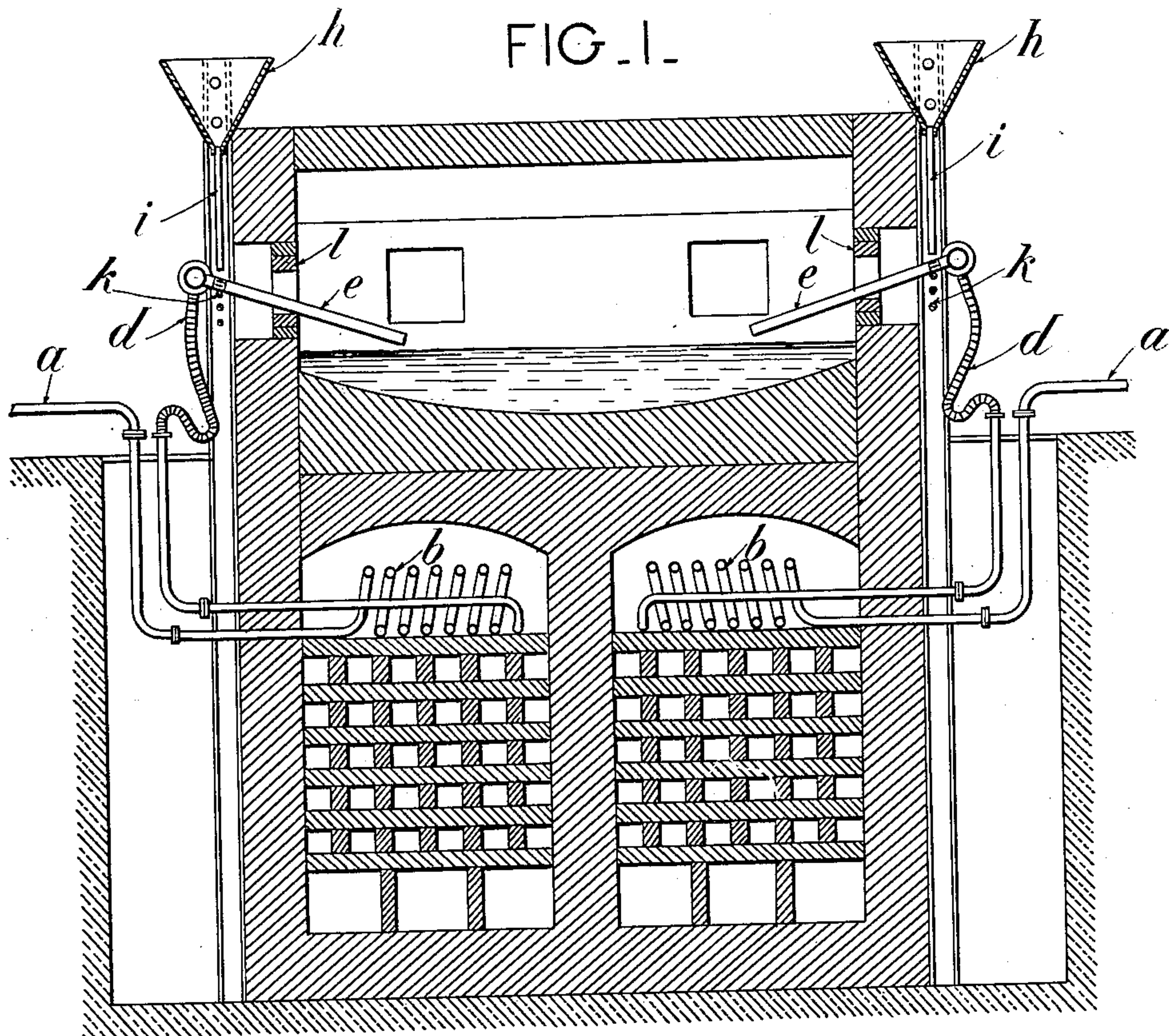
No. 723,501.

PATENTED MAR. 24, 1903.

H. G. C. THOFEHRN.
MANUFACTURE OF STEEL.
APPLICATION FILED DEC. 17, 1902.

2 SHEETS—SHEET 1.

NO MODEL.



WITNESSES

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J. M. Downing

INVENTOR

Hermann Georges Christian Thofehn

By *Richard R.*

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2 SHEETS—SHEET 2.

NO MODEL.

FIG.3.

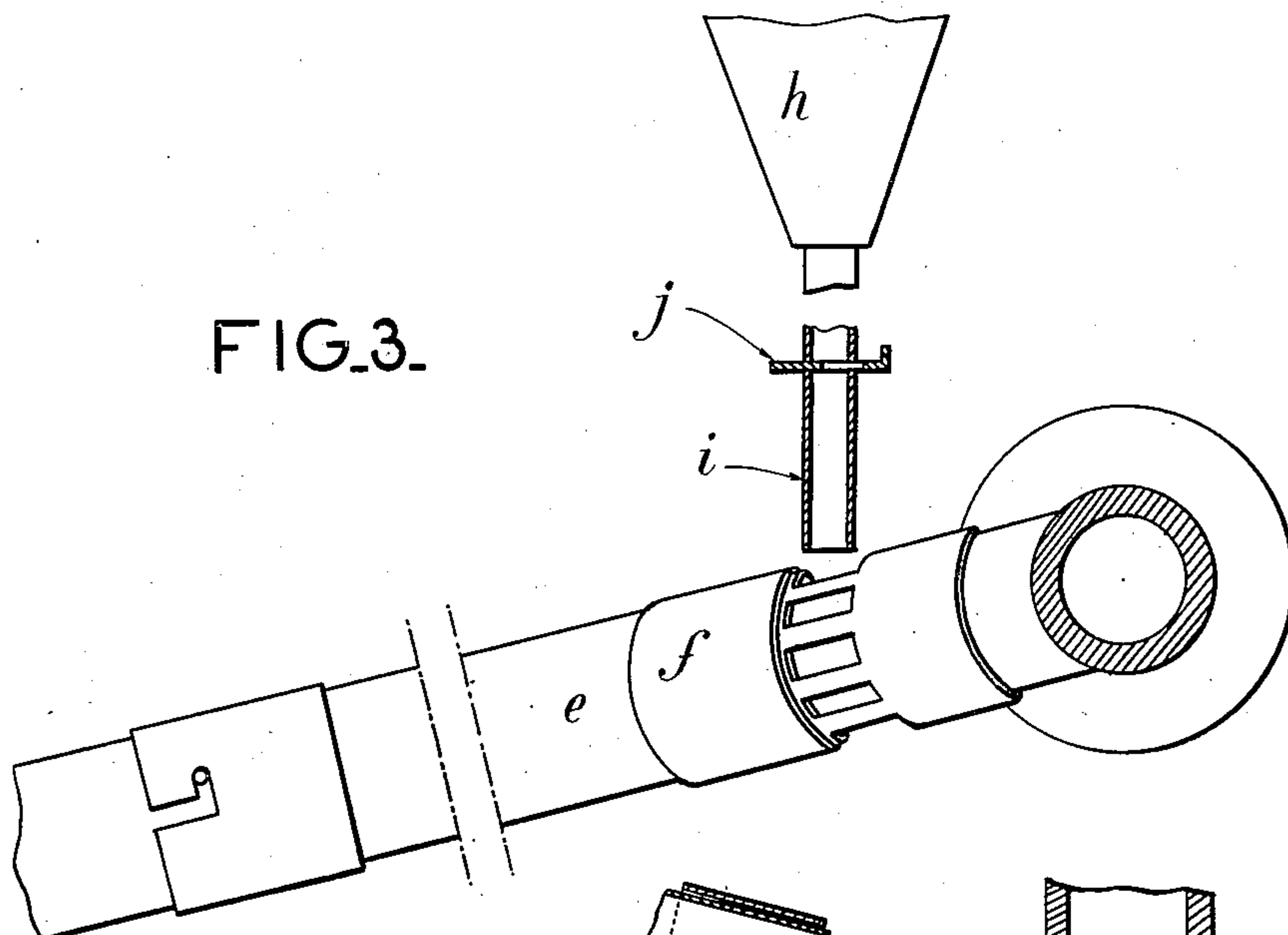
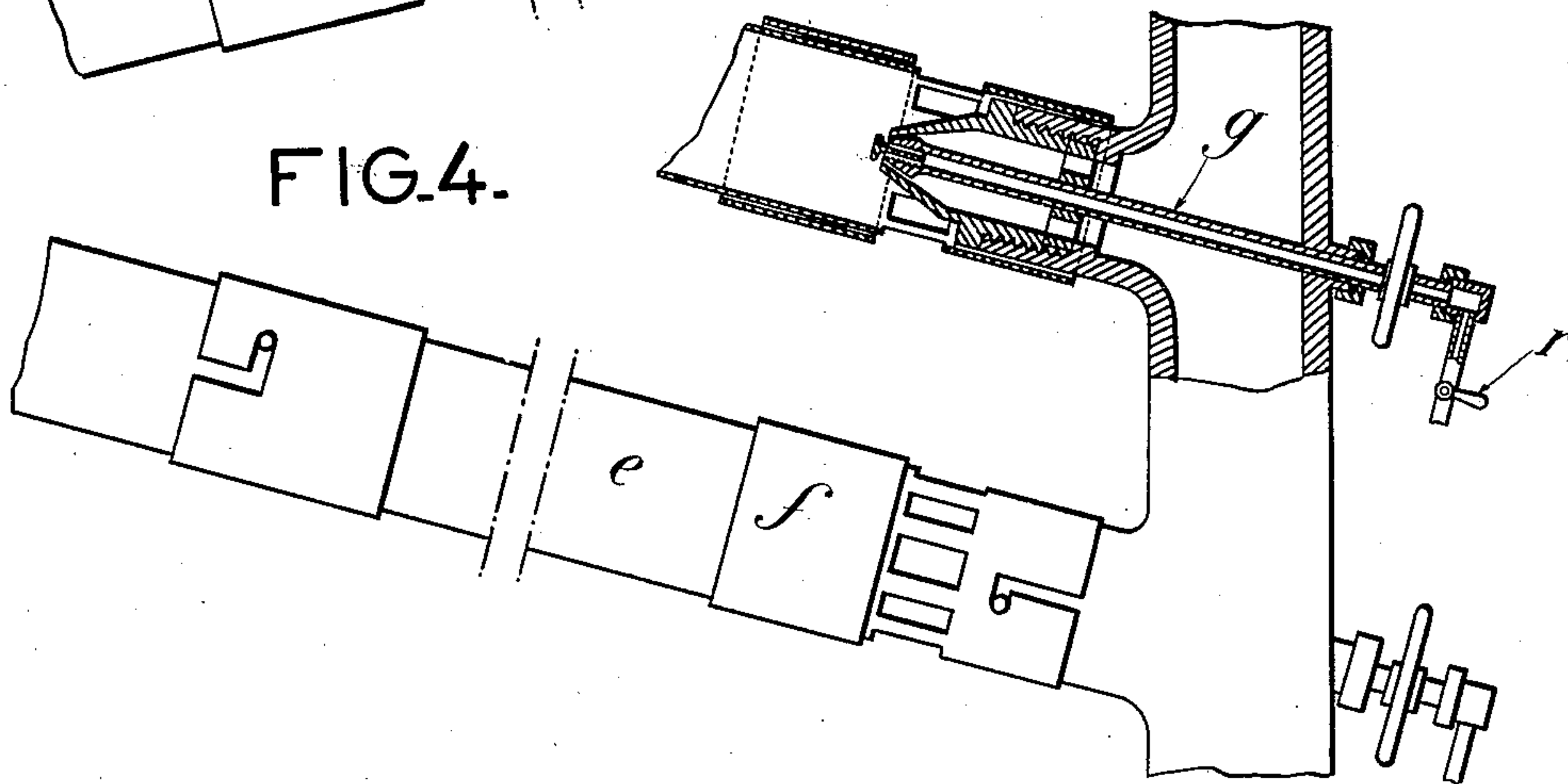


FIG.4.



WITNESSES

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UNITED STATES PATENT OFFICE.

HERMANN GEORGES CHRISTIAN THOFEHRN, OF PARIS, FRANCE.

MANUFACTURE OF STEEL.

SPECIFICATION forming part of Letters Patent No. 723,501, dated March 24, 1903.

Application filed December 17, 1902. Serial No. 135,609. (No model.)

To all whom it may concern:

Be it known that I, HERMANN GEORGES CHRISTIAN THOFEHRN, civil engineer, a citizen of the United States of America, and a resident of No. 350 Rue St. Honoré, Paris, in the Republic of France, have invented certain new and useful Improvements in the Manufacture of Steel, of which the following is a specification.

10 This invention relates to important improvements in the manufacture of steel, consisting in melting cast-iron or pouring it already melted in a hearth-furnace, such as a Martin furnace or the like, and in blowing
15 onto the surface of the metallic bath by means of blast-pipes distributed around the furnace according to directions tangential with a circle having its center about in the middle of the melted mass a mixture of air, steam, lime
20 reduced into grains, and hydrocarbons. The presence of the hydrocarbons produces on the surface of the bath in the zone where the blowing is effected a considerable increase of heat, so that the chemical reactions which are
25 necessary for the treatment are produced rapidly and thoroughly, and the temperature is, besides, increased to a degree which is sufficient to maintain the mass liquid during the formation of the steel, which would be im-
30 possible to obtain in such a treatment without said hydrocarbons. The reactions obtained by the compound jet are a strong oxidation of the bath, resulting from the presence of steam and air, which produces, with
35 the carbon, sulfur, and arsenic, the formation of volatile products, which escape, and which produces at the same time, with the other substances to be eliminated, such as silica and phosphorus, oxids which by getting
40 combined to the lime blown in forms a slag which floats on the bath. At the same time the mechanical effect of the blast-pipe jets produces a whirling on the surface of the bath about in the middle of the furnace,
45 which drives the slag formed away from the zone of action of said blast-pipes, so that this slag forms a layer on the outer surface of the bath, which protects it from the contact of the heating-gases coming from the hearth. The
50 slag which accumulates against the walls of the furnace protects at the same time said walls against corrosion. On the contrary, in

the zone of action of the blast-pipes—that is to say, about in the middle of the molten bath—the jets act constantly on fresh parts 55 of the mass to be treated and produce very rapidly simultaneous oxidation and scorification on account of the high temperature and without it being possible that the products resulting from these reactions mix with 60 the remaining mass of the bath. The slag is drawn away at suitable intervals by the working doors of the furnace.

The accompanying drawings show as an example a hearth-furnace arranged for carrying out my treatment. 65

Figure 1 is a vertical section of the furnace. Fig. 2 is a sectional plan view. Fig. 3 is a partial elevation view of the hopper in which the granulated lime is placed and of 70 the blast-pipe. Fig. 4 is a plan view, partially broken away, of the two blast-pipes coupled.

The furnace illustrated in the drawings is an ordinary gas-furnace, in which special arrangements have been provided allowing to 75 carry out the new manufacture. The steam arrives through the pipes *a*, passes through the coiled pipes *b*, arranged in the regenerating-chambers of the furnace, and passes from 80 there by flexible tubes *d* to the blast-pipes *e*. These blast-pipes, Figs. 3 and 4, can be more or less opened by means of a socket or sleeve *f*, provided with orifices for regulating the quantity of air to be driven into the furnace. 85 The quantity of steam admitted is regulated by the valve *g*, and the quantity of hydrocarbon which may flow through the hollow rod of said valve is regulated by a cock *r*, placed on the conduit which connects the valve with 90 the reservoir. The lime in a suitable state of division is placed in a hopper or box *h*, bolted, for instance, on the T-irons of the vertical uprights serving to secure the furnace. This hopper terminates in a tube *i*, which extends 95 vertically and quite close to the air-inlet orifices of the blast-pipe. A damper *j*, placed in the tube *i* and provided with a longitudinal aperture, permits of regulating the quantity of lime which falls through the tube and 100 which is sucked by the blowing in of steam through the orifices of the blast-pipe.

The blast-pipes may rest outside the furnace on metal rods *k*, arranged on the T-irons

of the furnace, and inside on fire-bricks 7.
On lowering the rods *k* and removing the
bricks the position of the blast-pipes can be
varied as to height, at the same time keeping
5 the same inclination. The ends of the blast-
pipes which are subjected to the action of the
heat of the furnace are easily removable by
means of bayonet-joints, as shown in Figs. 3
and 4.

10 For a treatment as above described a neu-
tral or, preferably, basic lining is employed
or also a lining of very pure chrome minerals
or any other lining adapted to this kind of
work.

15 The object of the treatment is to diminish
the proportion of carbon in the metallic bath
and to eliminate the impurities, which are
generally silicon, a small quantity of sulfur,
arsenic, phosphorus, and the like. It is pref-
20 erable to operate with considerable quanti-
ties, (thirty to one hundred tons at a time,)
so as to have time to examine the samples re-
moved without interrupting the treatment,
which is rapid. This treatment is rather deli-
25 cate, the quantity of carbon remaining in the
bath being somewhat small and it being nec-
essary to maintain it within very narrow lim-
its. Great attention must be paid to the for-
mation of the protective layer of slag. As to

the blowing in of hydrocarbons, it enables me 30
to obtain a very high temperature necessary
for the reactions and for keeping the mass in
a fluid state.

Having now described my invention, what
I claim as new, and desire to secure by Letters 35
Patent, is—

1. A process for the manufacture of steel
consisting in blowing in a hearth-furnace, on
the surface of a cast-iron bath and by means
of blast-pipes, a mixture of air, steam, lime 40
and hydrocarbons, substantially as and for
the purpose set forth.

2. A process for the manufacture of steel
consisting in blowing in a hearth-furnace, on
the surface of a cast-iron bath and by means 45
of blast-pipes arranged around the furnace ac-
cording to the direction tangential with a cir-
cle having its center about in the middle of
the melted mass, a mixture of air, steam, lime
and hydrocarbons, substantially as and for 50
the purpose set forth.

In witness whereof I have hereunto set my
hand in presence of two witnesses.

HERMANN GEORGES CHRISTIAN THOFERN.

Witnesses:

LOUIS MOSES,

EDWARD P. MACLEAN.