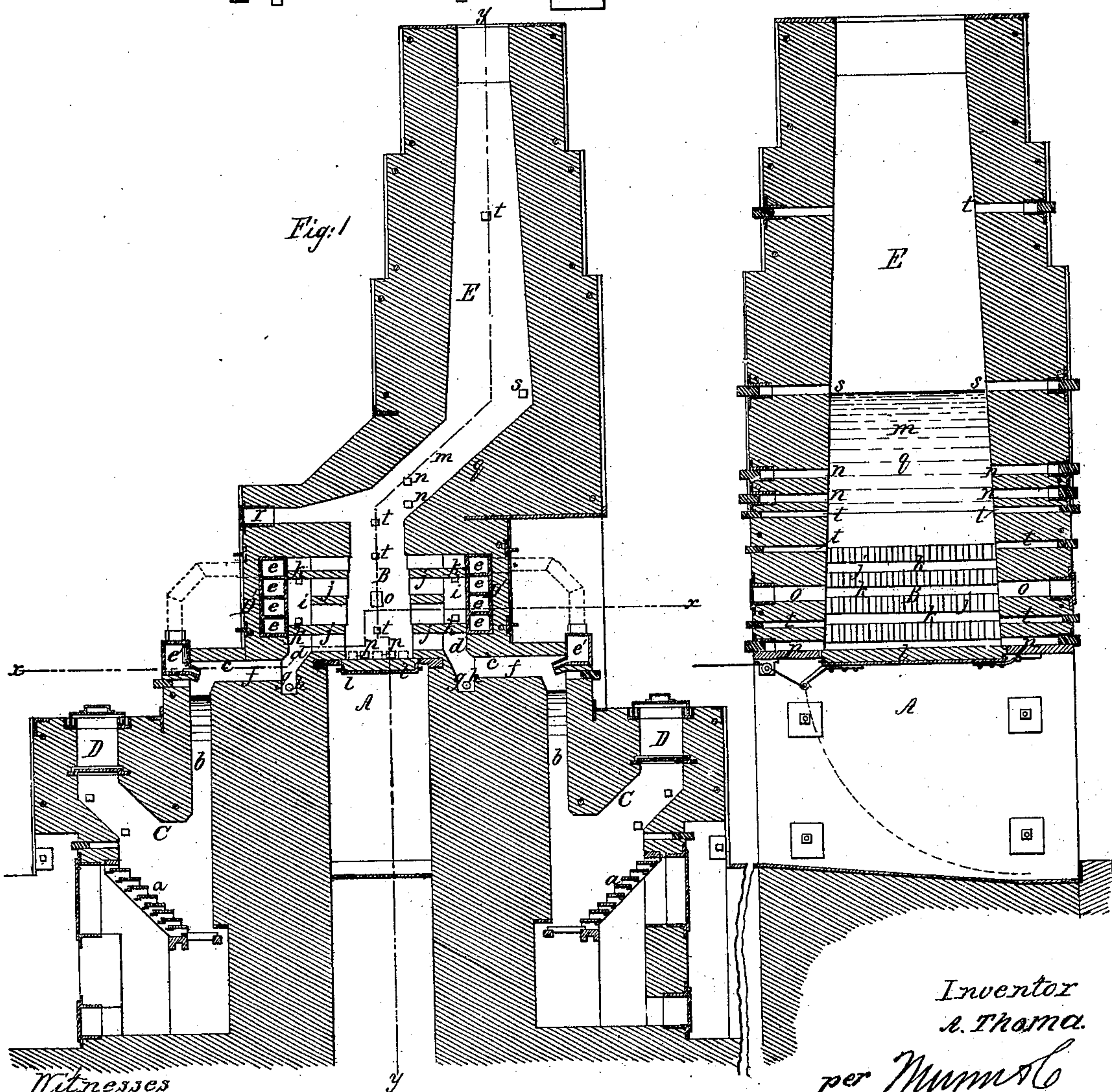
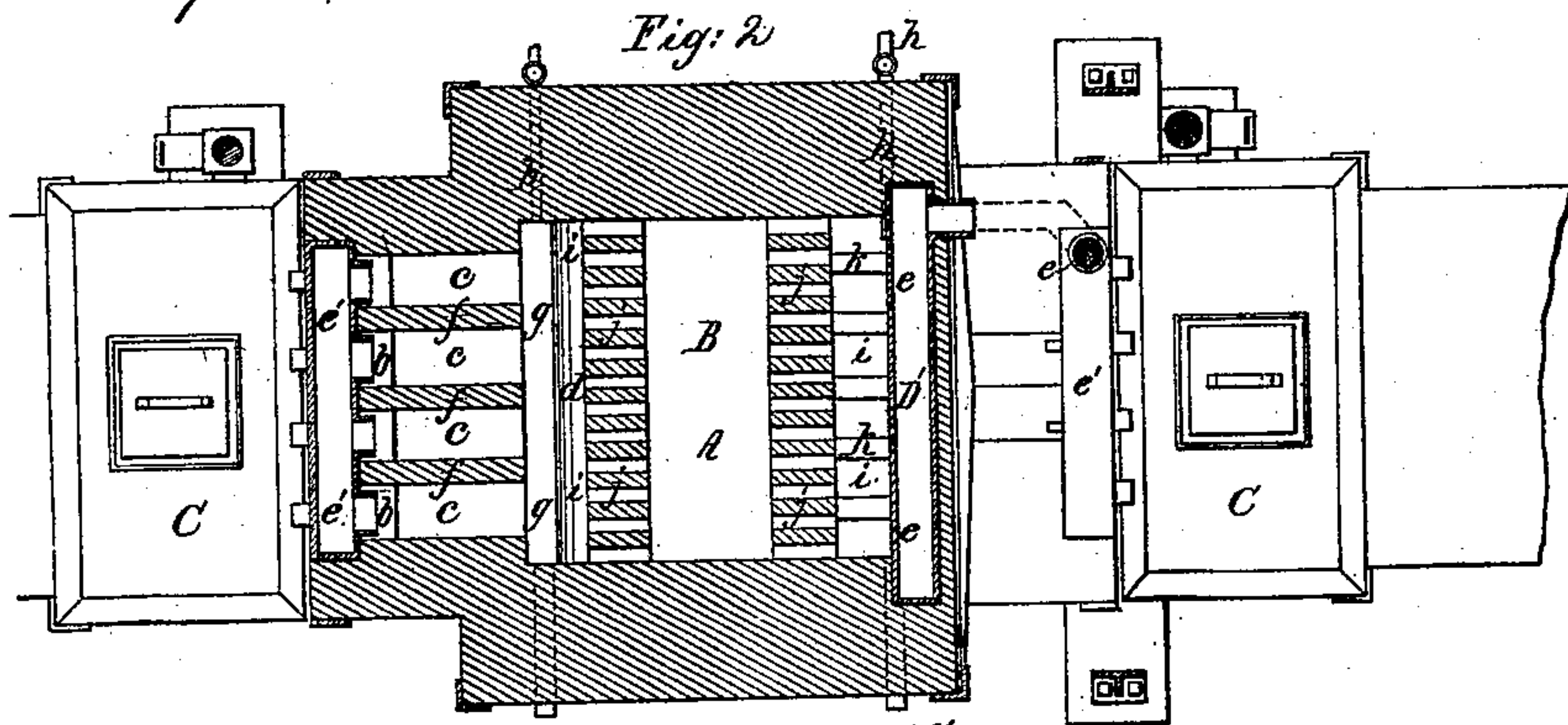


*A. Thoma,*

*Converting Cast Iron into Steel*

*No 96.633.*

*Patented Nov. 9. 1869*



*Witnesses*  
*Wm A Morgan*  
*P. C. Dietrich*

*Inventor*  
*A. Thoma.*  
*per Wm A Morgan*  
*Attorneys.*



# United States Patent Office.

ALOIS THOMA, OF NEW YORK, N. Y.

Letters Patent No. 96,623, dated November 9, 1869.

## IMPROVED PROCESS AND APPARATUS FOR CONVERTING CAST-IRON INTO STEEL.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, ALOIS THOMA, of the city, county, and State of New York, have invented a new and improved Furnace for Converting Pig-Iron into Steel, and for purifying and oxidizing other metals and minerals; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawings, in which—

Figure 1 represents a longitudinal vertical section of my improved converting-furnace.

Figure 2 is a horizontal section of the same, taken on the plane of the line *x x*, fig. 1.

Figure 3 is a vertical transverse section of the same, taken on the plane of the line *y y*, fig. 1.

Similar letters of reference indicate corresponding parts.

This invention has for its object the construction of a converting-furnace, which allows a continuous operation, and in which, therefore, a much larger quantity of material can be treated in a given time, than can be done in those furnaces which require removal of old contents before the new can be put in.

The invention relates to certain improvements on the converting-furnace, for which Letters Patent, No. 75,078, were granted to me on the 3d day of March, 1868.

The furnace has an upright tube, through which the material to be converted or oxidized is put in, and in which the same is retained and heated preparatory to its entering the converting-chamber.

The process of converting or oxidizing will thereby be considerably hastened and facilitated.

The conversion of pig-iron into steel is produced by means of the burned gases created by the combustion of any kind of fuel, such as bituminous, anthracite, or brown coal, wood, peat, or charcoal, which gases are mixed with water-gas, obtained as hereinafter specified.

This compound is brought, in a highly-heated state, in contact with the pig-iron which is to be converted, and raises the temperature of the same to from 1300° to 1650° Fahrenheit, and at the same time converts it into steel.

This process is extremely cheap and convenient, and will operate with great rapidity.

The main part of the furnace is a vertical shaft, A, in the upper part of which the converting-chamber B is arranged.

On two opposite sides of the shaft are the fire-places or gas-generators C C, which are adapted to any suitable kind of fuel, by altering the shape of their grates *a*.

On the grates *a a* is the fuel to be burned, it being

put on by a feeding apparatus, D, which is similar in construction to that described in a patent application for smelting-furnaces, made by me on or about the 24th day of October, 1868.

From each furnace projects a narrow upright channel, *b*, which enters a horizontal chamber, *c*, that communicates, by means of a channel, *d*, with the converting-chamber B.

The two gas-generating devices, with their chambers and channels *b c d*, are exactly alike, and the description of one side will suffice for both.

The gases arising from the generators C have to be burned before they enter the converting-chamber.

For this purpose, heated air is, through channels *e e'*, conducted into the chambers *c*, and each of the chambers *c*, is, by means of a series of parallel vertical partitions *f f*, divided into a series of channels, in order to have more heating-surfaces.

The said partitions are made incandescent before the gases enter them.

Where the chambers *c* and *d* meet, is formed a channel-shaped depression or trough, *g*, into which, through a pipe, *h*, water is conducted, the flow of which is regulated by suitable stop-cocks.

The water will, as soon as it enters the heated channel *g*, be converted into steam, and the steam will, by the extreme heat, be converted into water-gas.

This water-gas, which is no more steam, as it is too highly superheated, is easily decomposed, and is a very powerful means for decarbonizing pig-iron, for removing sulphur, arsenic, and other impurities, and in combination with the burned gases, for converting pig-iron into steel.

The burned gases combine with the water-gas in the chamber *d*, and rise thence into a chamber, *i*, which is separated from the converting-chamber by means of a perforated wall or partition, *j*, as shown.

These partitions are braced by means of fire-brick *k k*, which serve also to detain the rising gases, and cause part of them to enter the lower part of the converting-chamber, through the lower aperture of *j*.

The inner faces of the partitions *j* are provided with pendent inverted steps, as shown, to prevent any material from entering the apertures, and from being retained therein.

The outer side of the chamber *i* is formed by a metal case, D', through which, in zigzag pipes *e e*, air is forced.

The air is heated in these pipes, and is, in the heated state, blown into the chambers *c*, as aforesaid.

The bottom of the converting-chamber B is formed by a swinging plate, *l*, which, when swung down, discharges the contents of the chamber into the lower part of the shaft A.

Doors, *o*, are in the sides of the chamber B, to al-



low the inspection of the contents, and the taking out of contents.

Above the chamber B is an upright chimney-shaped structure, E, which does, through an inclined channel, *m*, communicate with the chamber B, as in fig. 1.

The pig-iron to be converted is put into the shaft E from above, and is, at the lower part of the inclined channel *m*, detained by iron bars, that are inserted through apertures *n n*.

When the chamber B is to be supplied, the bars are removed, and the contents of the upper shaft drop down. They would be apt to injure the swinging bottom *l* by the fall, to prevent which, bars are placed above the bottom, previous to the charging of the converting-chamber, said bars being inserted through openings *p p*.

These latter bars are drawn out when the chamber B is filled, and let the weight down upon *l*.

When the chamber B is emptied by swinging down the door *l*, and when the said door is again closed, the pig-iron, which is, by the ascending gases, already prepared in the shaft E, is let down by removing the detaining-bars.

The descent of the iron on the inclined plane *q* of the channel *m*, can be facilitated by means of a stirrer, inserted through a door, *r*.

The shaft E is refilled as soon as a charge of raw iron has been let down into the converting-chamber.

*s s* are openings, to allow the insertion of bars for facilitating the descent of the pig-iron.

*t t* are apertures, to allow the inspection of the interior.

The operation of this furnace is extremely simple, and can be carried on by every ordinary laborer.

The converting-chamber should be large enough to contain about thirteen thousand pounds pig-iron, which is, in about sixteen hours, converted into steel, after having previously been prepared in the shaft E.

As any suitable kind of fuel can be used with equal success in this furnace, and as an excellent quality of steel is produced, this process and furnace will be proved preferable to all others now in use.

The furnace can also be used for oxidizing all sorts of metals and minerals, and for purifying the same.

I claim as new, and desire to secure by Letters Patent—

1. The arrangement of the swinging plate *l*, between the converting-chamber B and adjacent part of shaft A, as and for the purpose specified.

2. The combination of the generators C, heated-air channels *e*, water-chamber *g*, and channel *b*, with the mixing-channel *d*, whereby a combined gas is produced, by which the pig-iron may be converted into steel, as set forth.

3. The arrangement, in converting-chamber B, of the protecting-bars *p p*, to break the fall of metal, as it slides from incline *q*, after the removal of bars *n n*.

4. The arrangement, with respect to each other, of the metal-feeding shaft E, inclined channel *m*, and converting-chamber B, as described, the first to feed the crude iron by gravity, the second to decrease its pressure, and the third to contain the converting-gases.

5. The arrangement of the air-heating case D', in the outer wall of the chamber *i*, for the purpose set forth.

6. The method, above described, of converting crude pig-iron into steel, by conveying, through separate channels, intensely-heated carbonic oxide, highly rarefied air, and superheated steam, into a common mixing-channel, from whence the combination of gases is transmitted to the converting-chamber.

ALOIS THOMA.

Witnesses:

FRANK BLOCKLEY,  
ALEX. F. ROBERTS.