

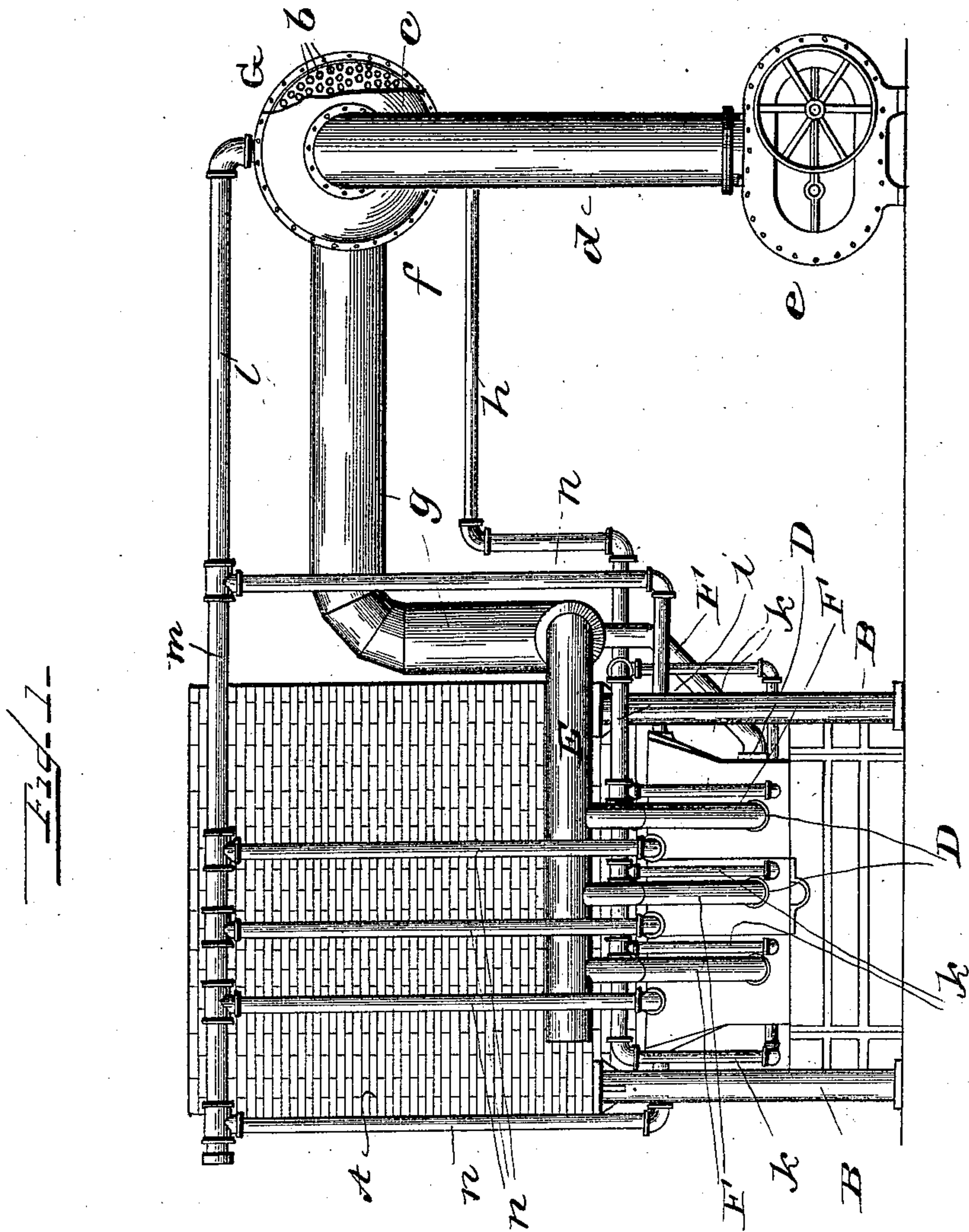
(No Model.)

3 Sheets—Sheet 1.

W. PENBERTHY.
BLAST FURNACE.

No. 545,718.

Patented Sept. 3, 1895.



Witnesses
J. A. Pauberschmitt.
D. Wiener Reinold

Inventor
William Penberthy
By D. E. Reinold
Attorney

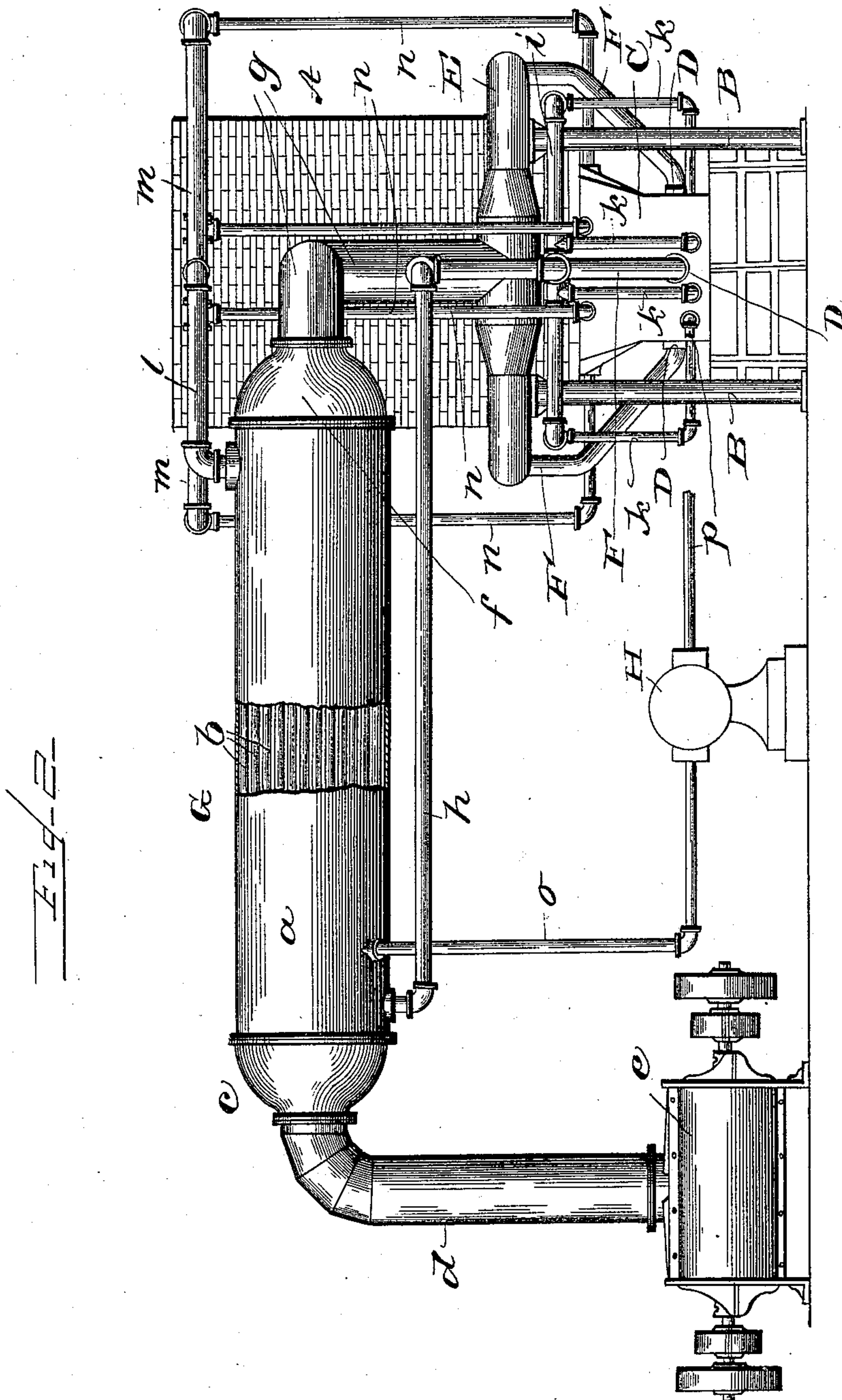
(No Model.)

3 Sheets—Sheet 2.

W. PENBERTHY.
BLAST FURNACE.

No. 545,718.

Patented Sept. 3, 1895.



Witnesses
G. A. Pauberschmidt,
D. Wimmer, Reinold.

Inventor
William Penberthy
By D. E. Reinold
Attorney

(No Model.)

3 Sheets- Sheet 3.

W. PENBERTHY.
BLAST FURNACE.

No. 545,718.

Patented Sept. 3, 1895.

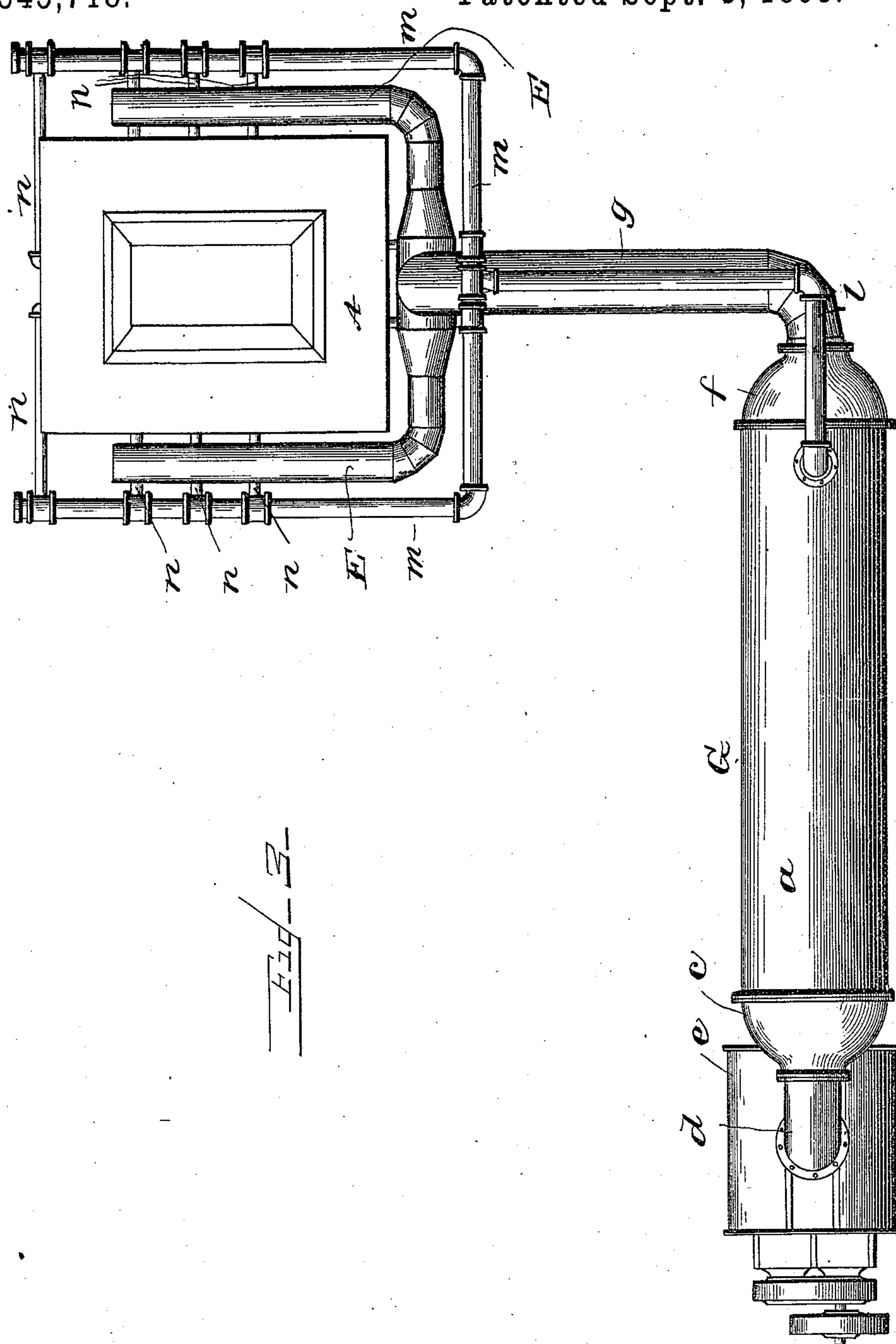


Fig. 3-

Witnesses
O. A. Pauberschmitt,
D. Wimmer Reinohl.

Inventor
William Penberthy
By D. L. Reinohl
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM PENBERTHY, OF DENVER, COLORADO.

BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 545,718, dated September 3, 1895.

Application filed May 6, 1895. Serial No. 548,305. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM PENBERTHY, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Blast-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to water-jacketed blast-furnaces, and has for its object certain improvements whereby the air supplied to the furnace as blast is heated and the water used in the jacket of the furnace cooled, thereby accomplishing a threefold purpose, namely, first, reducing the quantity of water required to supply the jacket by using the same body of water over and over again, thereby saving the power expended in pumping water; second, cooling the water after it has been heated in the water-jacket, and, third, heating the air on its way to the tuyeres and thereby economizing the furnace heat.

The invention will be fully disclosed in the following specification and claims.

In the accompanying drawings, which form part of this specification, Figure 1 represents an end view of my improved furnace; Fig. 2, a side view of the same, and Fig. 3 a top plan view.

Reference being had to the drawings and the letters thereon, A indicates the stack of a furnace, B the columns upon which the masonry is supported, C the water-jacket which surrounds the furnace, D the tuyeres, E the bustle-pipe, and F the pipes connecting the bustle-pipe to the tuyeres, any or all of which may be of any preferred approved form of construction.

G indicates a receptacle or reservoir, in which the air is heated and the water cooled, and consists of an elongated cylindrical body *a*, having a number of tubes *b* therein, through which the air passes on its way to the bustle-pipe E, and which tubes are surrounded by hot water from the water-jacket C, a head *c*, to which is attached the blast-pipe *d*, supplied from any suitable blower, as *e*, and a head *f*, to which is connected pipe *g*, which communicates with the bustle-pipe E. To the lower

side of the receptacle or reservoir G is attached a pipe *h*, which is connected to a distributing pipe *i*, which in turn is connected to the lower part of the water-jacket C by ingress-pipes *k*, and to the upper side of the reservoir G is connected a pipe *l*, which is connected to a receiving-pipe *m*, which in turn is connected to the upper part of the water-jacket C by egress-pipes *n* to maintain an automatic circulation of the water in the water-jacket and the reservoir. The circulation of the water may, however, be maintained by means of a pump H, which is connected to the reservoir G by a pipe *o* and to the water-jacket C by a pipe *p*. The body of the receptacle G is of the ordinary multitubular construction of water and air heaters such as prevail in the tubular boilers and feed-water heaters and condensers in which the tubes are supported in a transverse plate at their ends and the space around the tubes forms a water-chamber.

The operation is as follows: Before starting the fire in the furnace the water-jacket C, the receptacle or reservoir G, and all their connecting-pipes are filled with water from any suitable source of supply, the fire started, and when the fuel has become thoroughly ignited the air-blast is put on. As soon as the water in the water-jacket C becomes heated to a degree to produce ebullition, it rises in the pipes *n* to the receiving-pipe *m* and flows into the reservoir G at the inner end thereof through pipe *l*, passes forward in the reservoir around the tubes *a*, heating the air passing through said tubes, and is returned from the outer end of the reservoir through pipe *h*, distributing-pipe *i*, and pipe *k* to the lower part of the water-jacket C, thus maintaining a constant circulation of the same body of water and heating the air-blast by the use of the water in the reservoir G and at the same time cooling the water by air passing through the tubes in the reservoir, which are surrounded by the water.

In the use of water-jackets for cooling furnaces the water passing through the jacket in the ordinary way precipitates the sediment of the constantly changing and consequently large amount of water used in the jacket on the bottom and sides of the interior of the jacket, which prevents the water coming in contact with the metal of which the jacket is constructed and results in the burning out of

the jacket at the parts exposed to the high degree of heat of the furnace. It is obvious that by using one body of water over and over again in the water-jacket the deposit of sediment is reduced to the minimum and the only additional supply of water required to be introduced into the water-jacket is that necessary to make up for loss by leakage in the connections for maintaining the circulation of the water.

The economy in heating the blast is apparent, in that no cost whatever attends it, but the low temperature of the air is utilized to cool the water for reuse in the water-jacket, and in the construction shown and described the air has the highest degree of the heat of the water imparted to it just before leaving the reservoir G and the water is at its lowest temperature just before being returned to the jacket C.

Having thus fully described my invention, what I claim is—

1. The combination of a blast furnace, a water-jacket, a receptacle separate from the jacket and provided with an air heating chamber and a water cooling chamber, means for supplying air to the air chamber of the receptacle and means for circulating the water of said jacket through the water chamber of said receptacle.

2. A blast furnace provided with a water-jacket, a receptacle separate from the jacket and provided with an air heating chamber and a water cooling chamber, in combination with means for supplying air to the air chamber of the receptacle and a system of pipes for conducting the hot water of the jacket to the water chamber of said receptacle and returning the cooled water to the jacket.

3. A blast furnace provided with a water-jacket, a distributing pipe communicating with the lower part thereof, a receiving pipe communicating with the upper part thereof, and a receptacle provided with separate air and water chambers and connected at opposite ends to said distributing and receiving pipes respectively, in combination with means for supplying air to the air chamber of said receptacle.

4. A blast furnace provided with a water-jacket, in combination with a receptacle pro-

vided with separate air heating and water cooling chambers, the air heating chamber comprising a plurality of tubes through which the air is conducted and the water cooling chamber surrounding said tubes, pipes for circulating the water of the jacket through the water chamber of the receptacle and means for supplying air to the air chamber of said receptacle.

5. The combination of a blast furnace, a water jacket surrounding the furnace a multitubular receptacle separate from the water jacket and in which air is heated and water cooled, means for supplying air to the tubes of the receptacle and means for circulating the water of said jacket through said receptacle around said tubes.

6. The combination of a blast furnace, a water jacket surrounding the furnace a receptacle for heating air for blast and cooling the water of the jacket provided with a plurality of tubes and a water chamber surrounding the tubes means for supplying air to said receptacle and suitable pipe connections for circulating the water of the furnace jacket through the chamber surrounding the tubes of the receptacle.

7. The combination of a blast furnace, a water jacket surrounding the furnace, a receptacle for heating air and cooling the water of the jacket, a bustle pipe connected to said receptacle, pipes connecting the bustle pipe to the tuyeres, means for supplying air to the receptacle and means for circulating the water of the jacket through said receptacle.

8. The combination with a blast furnace, a water jacket surrounding the furnace a multitubular receptacle separate from the jacket and having air chambers at both ends thereof, means for supplying air, and means for conducting the hot water from the jacket to one end of the water chamber of said receptacle and means for returning said water to said jacket.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM PENBERTHY.

Witnesses:

GEORGE O. KEELER,
JNO. G. L. DOHME.