

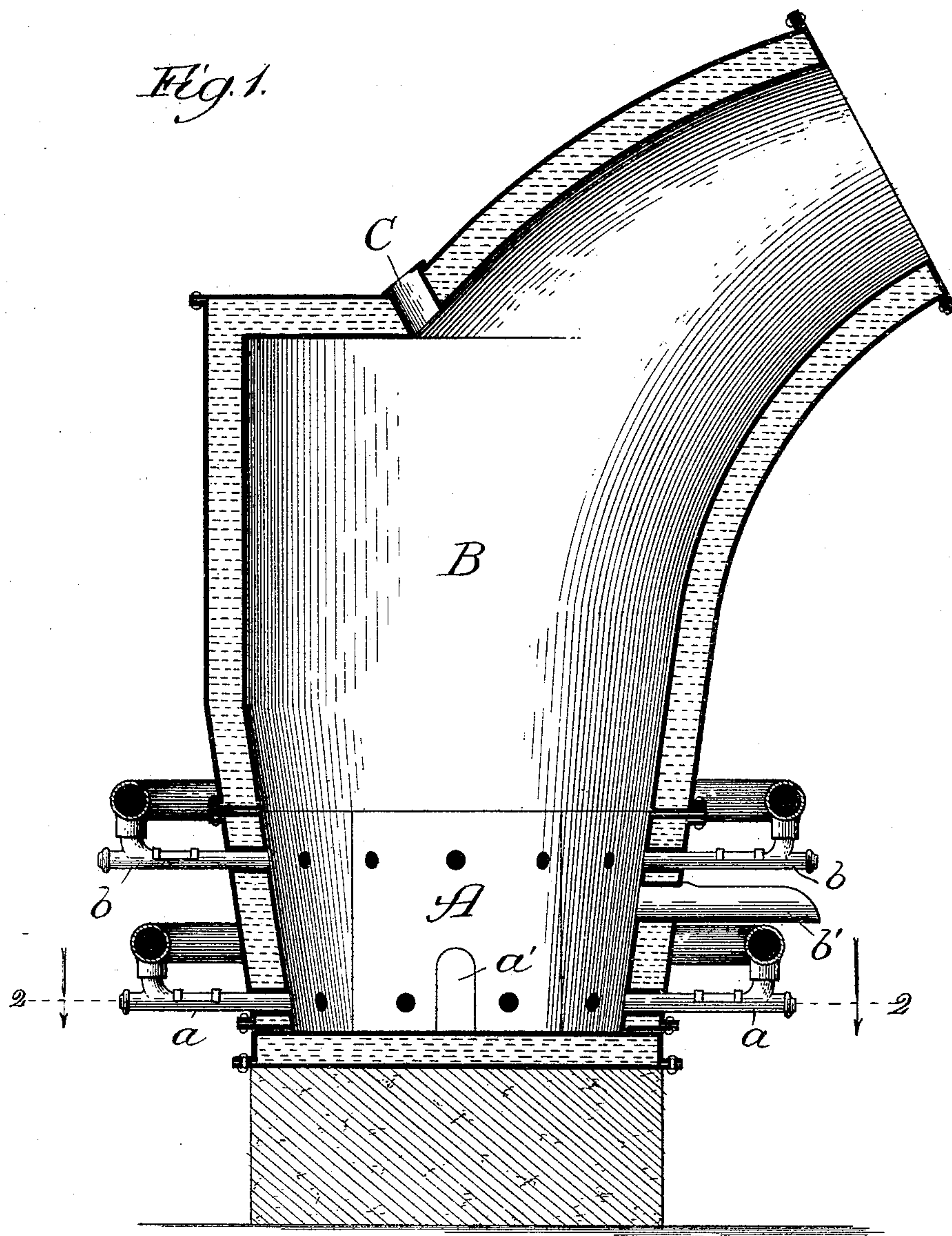
(No Model.)

2 Sheets—Sheet 1.

C. M. ALLEN.
CONVERTER.

No. 496,033.

Patented Apr. 25, 1893.



Witnesses:
Chas. E. Gaylord.
Clifford V. White.

Inventor:
Charles M. Allen,
By Banning & Banning & Payson,
Attys.

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Fig. 2.

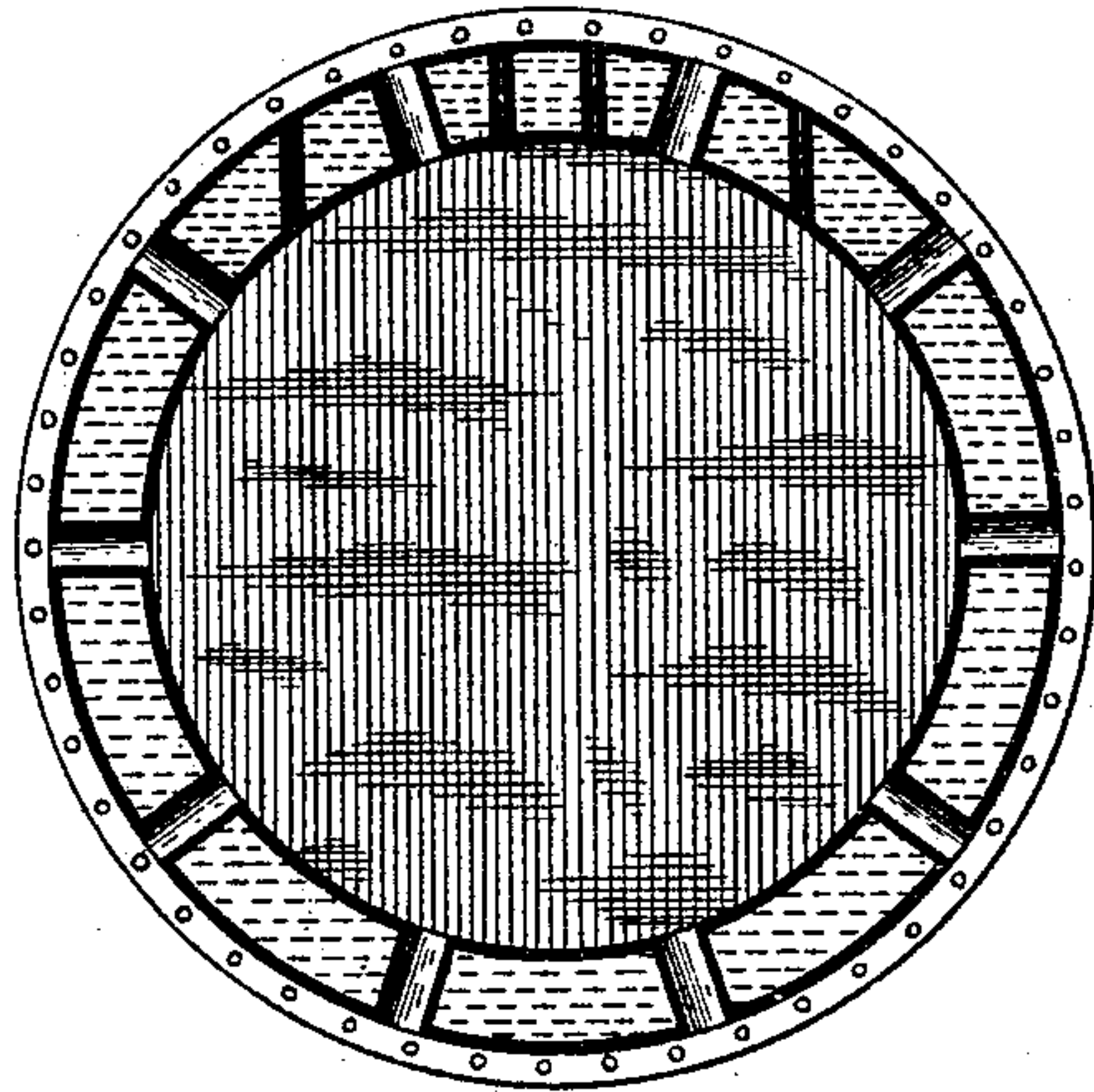


Fig. 3.

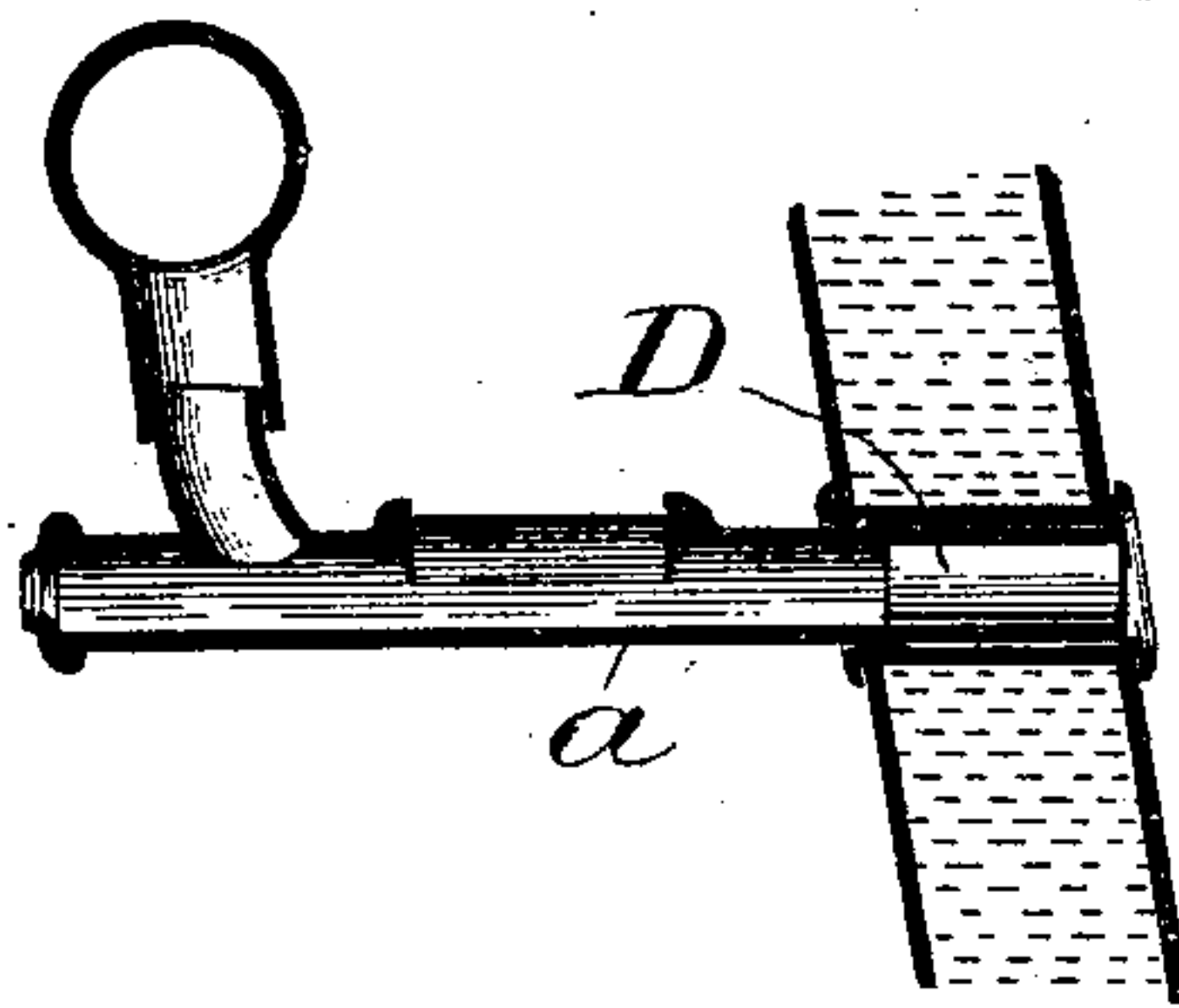


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES M. ALLEN, OF BUTTE, MONTANA, ASSIGNOR OF ONE-HALF TO
WILLIAM J. CHALMERS, OF CHICAGO, ILLINOIS, AND LAMARTINE C.
TRENT, OF SALT LAKE CITY, UTAH TERRITORY.

CONVERTER.

SPECIFICATION forming part of Letters Patent No. 496,033, dated April 25, 1893.

Application filed April 12, 1892. Serial No. 428,831. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. ALLEN, a citizen of the United States, residing at Butte City, in the county of Silver Bow and State of Montana, have invented a new and useful Improvement in Converters, of which the following is a specification.

The object of my invention is to make a combined blast furnace and converter; and the invention consists in the features and combinations hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical sectional elevation; Fig. 2 a cross section taken on line 2 of Fig. 1; Fig. 3 an enlarged sectional view of one of the tuyeres; and Fig. 4 a sectional view of the plug used for closing the tuyeres.

A is the converter, *a* the tuyeres, and *a'* the metal tap thereof; B the blast furnace, *b* the tuyeres, and *b'* the slag spout thereof; C the opening for the introduction of concentrates, ore, matte, or other substances to be treated; and D the plug for closing the tuyeres.

My improved blast furnace and converter may consist of one machine, in which the upper portion is a blast furnace and the lower portion a converter, or of two machines combined together, the upper one being a blast furnace and the lower one a converter. For convenience, however, I will describe it as consisting of two separate portions, calling the one a blast furnace and the other a converter. The blast furnace is of the usual form, and as shown is circular; but it may be square, oval, rectangular, or of any shape desired. The converter, which is stationary, is immediately under the blast furnace, the two thus practically forming one structure or machine, which rests upon any suitable base or support. The sides of the furnace and converter are preferably made of steel, iron or copper plates, with an intervening water space, as in the usual form of water jacket blast furnace, the bottom being also water jacketed. The sides extending down continuously form a chamber in the lower portion, which corresponds to the gradual continuous taper of the furnace; and, as just suggested, I prefer to have the water

jacket extend down and under this chamber so as to form both the sides and bottom thereof. The water-jacketed sides of the furnace coming into direct contact with the charge, the use of linings is rendered unnecessary. There are two rows of tuyeres, one above the other, the upper row being for the blast furnace, and the lower row for the converter. The tuyeres enter the chamber preferably at right angles to a perpendicular line drawn in the furnace, but this is not in all cases necessary. The raw sulphides, ore, matte, or other substances to be treated, are introduced through a suitable opening in the top or sides as may be most convenient. The top of the furnace may be so shaped that the particles thrown upward by the force of the blast will strike against a covering, preferably water jacketed, after which they will be conducted, along with the fumes and gases, into dust chambers or flues, where they will be deposited, the fumes and gases passing thence through a stack or chimney to the outer air.

Of course the lower tuyeres should be closed whenever it is desired not to convert; and the upper tuyeres closed whenever it is desired to convert. For this purpose I employ suitable plugs, made of the material to be treated, clay, or other metal. I prefer to make these plugs so that they may be driven in to open the tuyeres, and also to make them of the same material as that treated in the converter, so that when driven in there will be no loss or introduction of foreign matter into the charge. I also prefer to provide the converter with a suitable slag tap at a point higher than the metal tap, to permit the slag to be drawn off as desired. This slag tap is applicable to any form of converter, and therefore it will be understood that I do not intend to limit myself to its use in a combined converter and blast furnace, or in any particular form of converter—the novel feature in this respect consisting in providing a converter with a slag tap, such taps having been heretofore used in blast furnaces only.

In operation a wood fire is built in the bottom of the converter, after which coke is added, until a good coke fire is burning above

the tuyeres. A gentle blast is then turned on through the upper row of tuyeres, the lower row being closed, the metal being held through the brick breast and the slag tap being closed
5 with a suitable plug or stopper. After the coke is all aglow, the raw sulphides are added and the blast increased, gradually adding sulphides and coke until the molten mass reaches the upper tuyeres. The plugs in the lower
10 tuyeres being removed and a blast of sufficient pressure, according to the height of the charge, being turned on, the conversion of the sulphides to metals will immediately begin, the oxygen and sulphur uniting with
15 the air to form SO_2 , which escapes through the stack. The iron in the ore, present as a sulphide, which in this state refuses, even in the plastic condition, to unite with the silica (SiO_2) becomes an oxide (FeO) and unites with the
20 silica to form silicate of iron. By regulating the proportion of pyrites to silica or quartz, which can be readily done by previous concentration with jigs and vanners, or other concentrating machinery, or if necessary by the
25 addition to the charge of lime rock (CaCO_3) any desired slag can be produced. As the presence of sulphides of iron always reduces the oxides of copper, and as by use of this continuous process, fresh raw sulphides are constantly added, this operation is peculiarly
30 adapted to make good clean slag. After the blowing has progressed sufficiently the blast is stopped or checked and the material allowed to separate in the furnace, after which the slag tap is opened with a pointed bar or otherwise, as in other forms of blast furnace smelting, and a certain amount of slag allowed to
35 run out, the amount being determined by measurement in suitable vessels and approximated to the weight of the slag making material
40 treated, which has been previously determined

by the metallurgist in charge. Of course, care should be taken not to remove all the slag, a certain amount being necessary to arrest the
45 oxides formed in the converter below. These oxides are arrested by coming in contact with the molten sulphides on top of the metallic bath, or by passing through slag above the molten sulphides. A certain amount of metal, say, copper or lead, is now tapped out, during
50 which process an equal weight of sulphides is added to the charge from above. The tuyeres being reopened and the blast turned on again, the molten mass that remains, being at white heat, ignites the new charge immediately; and
55 so the process goes on continuously, the slag and metal being drawn off and ore added as in other smelting processes.

The advantages of my invention are that it provides for making a combined blast furnace and converter, in which raw sulphide
60 ores may be smelted, converted and refined in one operation, and in which the sulphur contained in the metallic sulphides may also be utilized as fuel. 65

I do not herein claim the process of smelting, converting and refining ores above described, the same being the subject of another application Serial No. 428,830, filed by me
70 April 12, 1892.

I claim—

In combination with an apparatus for treating ores or molten material and provided with tuyeres for the introduction of a blast, plugs for closing the tuyeres formed of the material
75 to be treated and adapted to be driven in to open the tuyeres, substantially as described.

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Witnesses:

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