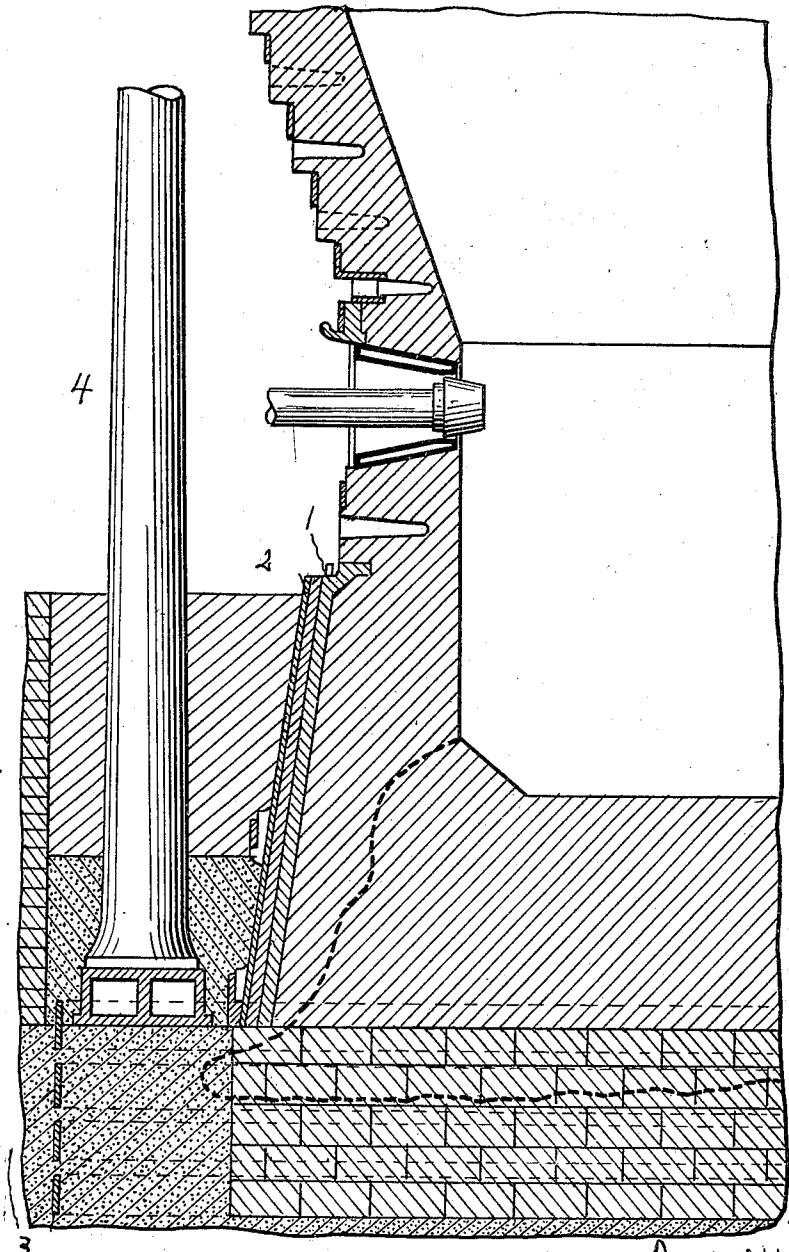
Nov. 11, 1924. 1,514,776

P. O. MENKE

BLAST FURNACE

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FIG. 1.



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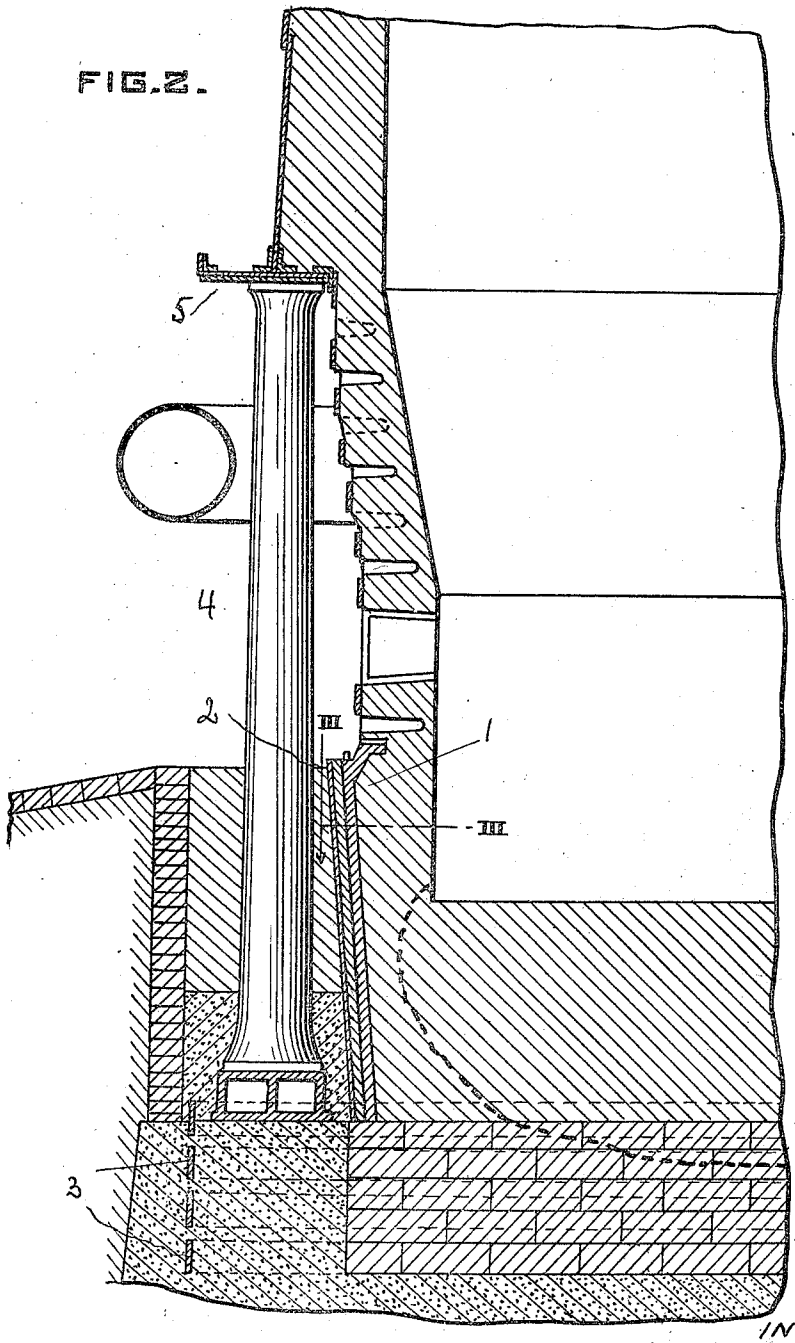
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FIG. 2.



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FIG.4.

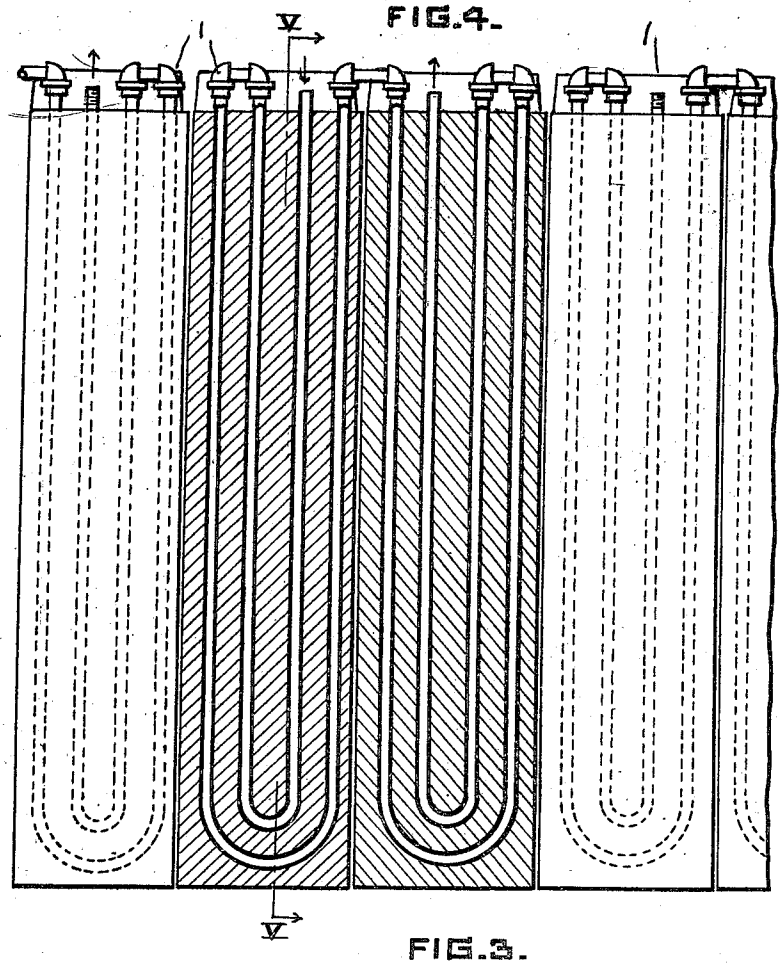


FIG.5.

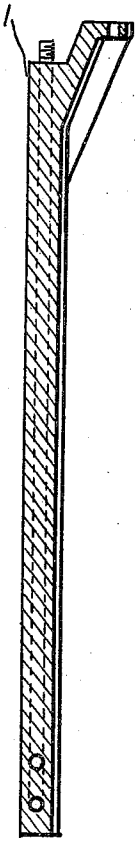
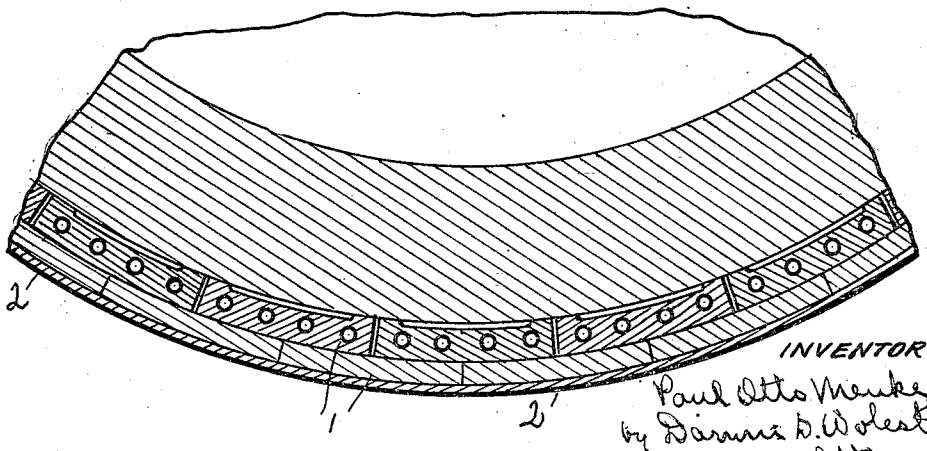


FIG.3.



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Patented Nov. 11, 1924. 1,514,776

UNITED STATES PATENT OFFICE.

PAUL OTTO MENKE, OF SHARON, PENNSYLVANIA.

BLAST FURNACE.

Application filed January 19, 1924. Serial No. 687,334.

To all whom it may concern:

Be it known that I, PAUL O. MENKE, residing at Sharon, in the county of Mercer and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Blast Furnaces, of which improvements the following is a specification.

It is customary to enclose the brick work forming the hearth with cooling plates through which water circulates, said plates being held in position by jackets. As is well known, the molten metal eats away the brick and gradually works its way down below the lower end of the cooling plates and jacket and at times will extend into the foundation outside of the jacket. It has been found that the destructive action of the hot metal will be checked horizontally by the cooling effect of the cooling plates, so that the outer wall of the salamander corresponds approximately with the inner surfaces of the cooling plates and jacket, which under the present practice are either conical, i. e., flaring from top to bottom, or cylindrical. With both forms of plates and jackets, the hot metal will, after passing below the jacket, extend horizontally beyond the jacket and cause "break out" which is destructive and frequently results in loss of life.

It has been found that the capacity of the furnace as at present constructed, can be greatly increased by merely enlarging the hearth diametrically. But any material enlargement of the hearths of furnaces having a conical or cylindrical hearth portion is difficult on account of the position of the base plate and the pillars supporting the upper portion of the furnace to the lower end of the cooling plate and jacket.

The object of the invention described and claimed herein is to provide for a reduction of the transverse area of the body of metal as it penetrates or eats its way downwardly through the bottom of the hearth and foundation. And it is a further object of the invention to provide for a large increase in the diameter of the hearth without disturbing the pillars supporting the upper portion of the furnace or the foundation plate for such pillars. The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification, Fig. 1 is a sectional elevation of the lower portion of a blast furnace as at present constructed. Fig. 2 is a view similar to Fig. 1 but having the lower or hearth portion embodying the improvement claimed herein; Fig. 3 is a sectional view on a plane indicated by the line III—III, Fig. 2; Fig. 4 illustrates partly in elevation and partly in section, cooling plates for the hearth; and Fig. 5 is a sectional elevation on a plane indicated by the line V—V, Fig. 4.

As shown in Fig. 1, the hearth portion of a blast furnace, i. e., the portion of the furnace below the tuyères, has been and is now made more or less conical. The brick work of this portion is enclosed by water cooled plates 1 held in place by a jacket 2. These cooling plates will maintain the brickwork for a certain depth at a temperature sufficiently low to prevent further penetration of the metal. On account of the outward flare from top to bottom of the water plates, the horizontal dimension of the body of the metal will increase as it moved down and in some cases when the body of metal extends below the lower ends of the cooling plates it will also move outwardly and coming into contact with the foundation rings on which the pillars supporting the upper portion of the furnace rest, will destroy or so weaken the rings that one or more of the pillars will drop, permitting what is known as a "break out."

As will be seen by reference to Fig. 1, the lower ends of the water cooled plates and jacket are surrounded by the foundation rings 3, which will prevent the employment of peripherally larger plates and jackets, as would be necessary in order to increase the internal diameter of the hearth.

The objectionable features of the present construction can be overcome by constructing the hearth portion of the furnace, i. e., the portion below the tuyères in the form of an inverted frustrum of a cone, as shown in Fig. 2. When so constructed, the lower ends of the cooling plates 1 and jacket 2 can be made of a diameter equal to and less than the internal diameter of the foundation rings, while the diameter of the upper ends of the plates and jackets can be made approximately equal to the distance between diametrically disposed pillars. While such a construction of hearth is very desirable when erecting a furnace, it is especially advantageous when it is desired to enlarge the hearth of an old furnace.

It has been found that, in blast furnaces as heretofore constructed, the capacity of the hearth has not been proportional to the delivery capacity of the stack and upper portion of the bosh, and that greater efficiency can be effected by increasing the diameter of the lower portion of the bosh and hearth. As the stack portion of the furnace is supported by the mantle plate 5 and pillars 4 independent of the bosh portion, such change can be readily made, but for reasons above stated, i. e., the employment of the conical cooling plates and jacket with their larger end down, an increase in the diameter of hearths, commensurate with the delivery of the stacks, could not be attained in prior constructions. But by reversing the position of the conical member, it is possible to increase the diameter of the hearth of furnaces now in use some three or four feet more or less.

By reference to Fig. 2 it will be seen that as the cooling plates incline inwardly from top to bottom, the horizontal penetration of the molten metal decreases as its vertical depth increases and the shape of the resulting salamander is approximately that of an inverted cone. As the body of metal is decreased, its temperature and consequent cutting action will decrease, and its vertical penetration will be less than under present conditions, and there will not be any lateral penetration below the lower end of the water cooling plates.

It is characteristic of the invention claimed herein that not only can the hearths of furnaces now in operation be increased in diameter, but also that in constructing new furnaces, a sufficiently large hearth can be had without changing the proportions of other parts which have been found desirable for a given size or capacity of furnace. A further advantage of the construction claimed herein is substantial freedom from bursting of the jacket due to expansion of the salamander. This is believed to be due to the fact that as the jacket is larger at its upper end, there is a possibility of upward movement of the part enclosed within the jacket, whereas in the construction heretofore employed, there cannot be any movement downward, but the force of expansion is exerted in radial lines.

I claim herein as my invention:

1. A blast furnace having cooling plates enclosing the hearth inclined inwardly from their upper ends.

2. A blast furnace having the portions below the tuyères in the form of an inverted frustrum of a cone and cooling plates surrounding such portion.

In testimony whereof, I have hereunto set my hand.

PAUL OTTO MENKE.