

C. PLAGGE.
BLAST FURNACE.

No. 179,342.

Patented June 27, 1876.

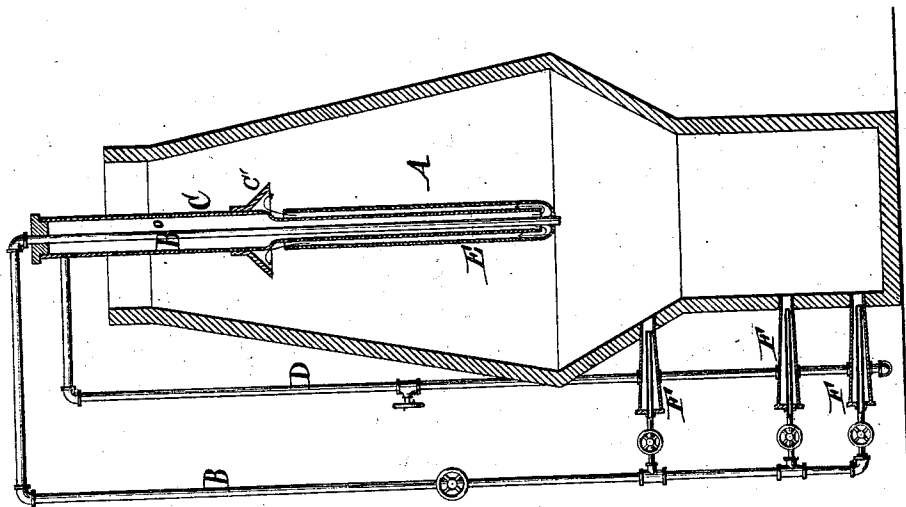


Fig. 2.

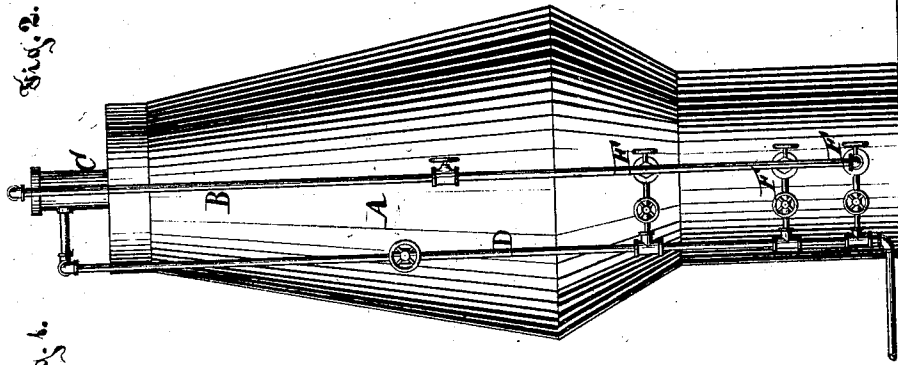


Fig. 1.

Witnesses
Otto Stiefelaud
Chas. Stahlen.

Inventor.
Charles Plagge
by Hans Anton Hauff
his atty.

UNITED STATES PATENT OFFICE.

CHARLES PLAGGE, OF NEW YORK, N. Y.

IMPROVEMENT IN BLAST-FURNACES.

Specification forming part of Letters Patent No. 179,342, dated June 27, 1876; application filed October 7, 1875.

To all whom it may concern:

Be it known that I, CHARLES PLAGGE, of the city, county, and State of New York, have invented a new and useful Improvement in Treating Metallic Ores, which improvement is fully set forth in the following specification, reference being had to the accompanying drawing, in which—

Figure 1 represents a side elevation of the furnace which I use in carrying out my invention. Fig. 2 is a vertical section of the same.

Similar letters indicate corresponding parts.

The object of my invention is to utilize liquid, vaporized, or gaseous hydrocarbons for the reduction and smelting of metals in blast-furnaces in a more economical and effective manner than heretofore practiced.

By analysis, calculation, and experiments I have found that a more intense and more and better metal is obtained by using 80.5 pounds of petroleum or other hydrocarbons, if forty-seven pounds thereof are burned, to carbonic acid and water, while the balance of 33.5 pounds is reserved for the reduction of the metal, than are obtained by the combustion of one hundred pounds of petroleum to carbonic oxide and water.

Instead of introducing the liquid, vaporized, or gaseous hydrocarbons together with the blast exclusively into the hearth or combustion-chamber of the furnace, I divide the blast and the hydrocarbons in such manner that into the hearth only that part is injected which is wanted to produce the heat required for the smelting of the metal and slag material, while the balance of the hydrocarbon and blast required for the heating, roasting, and reducing of the ore is introduced into the upper part (reducing-chamber) of the furnace.

The means which I have employed for carrying out my invention are represented in the drawing, in which—

The letter A designates a blast-furnace, into which liquid, vaporized, or gaseous hydrocarbons (such as petroleum, tar, or natural gas from gas-wells) are introduced by a pipe, B. When a liquid hydrocarbon is used this pipe connects with a suitable supply-tank, by preference situated at an elevation above the furnace, so that the liquid descends with a certain head, or the gaseous or liquid hydrocar-

bon may be driven into the furnace by any suitable forcing apparatus. The pipe B is provided with a branch pipe, B^o, which extends down through the top of the furnace into the reduction-chamber, or to such a depth as experience will show to be most advantageous. The descending portion of the pipe B^o is protected against the destructive heat by a tube, C, of larger diameter, leaving an annular space for the circulation of hot or cold blast, which is injected through the blast-pipe D. The pipe C is open at its bottom end, and it is surrounded by a jacket, E, closed below, and open at the top, just above which is located a deflector, C', attached to the pipe C, so that the blast has to pass clear down through the pipe C, and then up through the jacket E, before it can escape into the furnace, the escape taking place at a certain depth below the upper surface of the charge, but above the point at which the hydrocarbon vapors enter into the reducing zone or chamber of the furnace. The jacket E may be protected by a fire-proof coating and the outlets of the blast and of the hydrocarbon vapors. By this arrangement the blast introduced into the upper part of the furnace acts as a protection of the hydrocarbon-pipe, and it also serves to burn all hydrocarbon vapor or gas which may not have been utilized in the reduction of the ores. Its free oxygen also combines with deleterious admixtures of the ore and flux, and the heat thereby generated assists to expel the carbonic acid and moisture of the charges, and prepares the same for the reducing-zone. The hydrocarbon-pipe B connects also with tuyeres (one or more) F, which enter the combustion-chamber or hearth of the furnace, and which, in the example shown in the drawing, can be made to communicate with the blast-pipe, or, if desired, the hydrocarbons may be introduced separate from the blast. When this is done I introduce the hydrocarbons at a level somewhat below the level where the blast enters, thereby securing a complete combustion of the hydrocarbons, and avoiding the danger of oxidizing a part of the metal by the action of the blast.

The hydrocarbons may be made to enter the various zones of the blast-furnace either by their own gravity under pressure, or by

means of injectors, pumps, or other devices suitable for this purpose.

The advantages of my invention are as follows: First, a great economy in fuel, on account of its perfect combustion with the least amount of blast, the high temperature in the zone of combustion, and the utilization of the waste heat for roasting and preparing the new charges for the reducing-zone; second, a large increase in the daily output of metal, since the reducing capacity of the furnace is largely increased, no solid fuel being mixed with the charges, and the reduction and smelting down or the charges being quickened by the energetic action of the hydrocarbons; third, a superior quality of the metal is produced, because most of the impurities of the ore and flux are eliminated by the preliminary roasting before the charges enter the zone of reduction, and on account of the low temperature at which the reduction takes place, the reduced and carbonized metal on its way toward the hearth coming in contact only with neutral or slightly oxidizing or reducing gases (as the case may require) cannot absorb impurities from the slag material, since it requires a high temperature and highly deoxidizing gases for their reduction; fourth, the liquefaction of the metal and slag material in the hearth is not retarded by the heat-absorbing reduction of carbonic acid to carbonic oxide, which is the case when hydrocarbons are introduced exclusively into the hearth, as

heretofore practiced; fifth, the working of the blast-furnace is brought under easy control by the introduction of the hydrocarbons and heat to the various zones of the furnace, and in treating iron ore, for instance, I am enabled to produce not only iron of almost any desired degree of carbonization and great purity, but also steel or iron manganese from manganiferous iron ores, which require high heat and powerful reducing agents; sixth, where natural gas from gas-wells of sufficient pressure can be obtained the natural force of the gas serves to produce the necessary blast for the reduction and smelting of the ores, and injectors operated by the gas itself may be substituted for the blast-engines; seventh, no solid fuel having to be handled a great saving in labor is effected.

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

The combination, with a blast-furnace, of a pipe, B^o, entering through the top of the furnace, and projecting down into the reducing-zone thereof, and the blast-tube C, jacket E, and deflector C', all constructed and operating substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand and seal this 4th day of October, 1875.

CHAS. PLAGGE. [L. S.]

Witnesses:

W. HAUFF,

ROBT. E. MILLER.