(No Model.)

H. J. GRAF.

PROCESS OF MELTING IRON.

No. 454,209. Patented June 16, 1891.

Fig. 1.

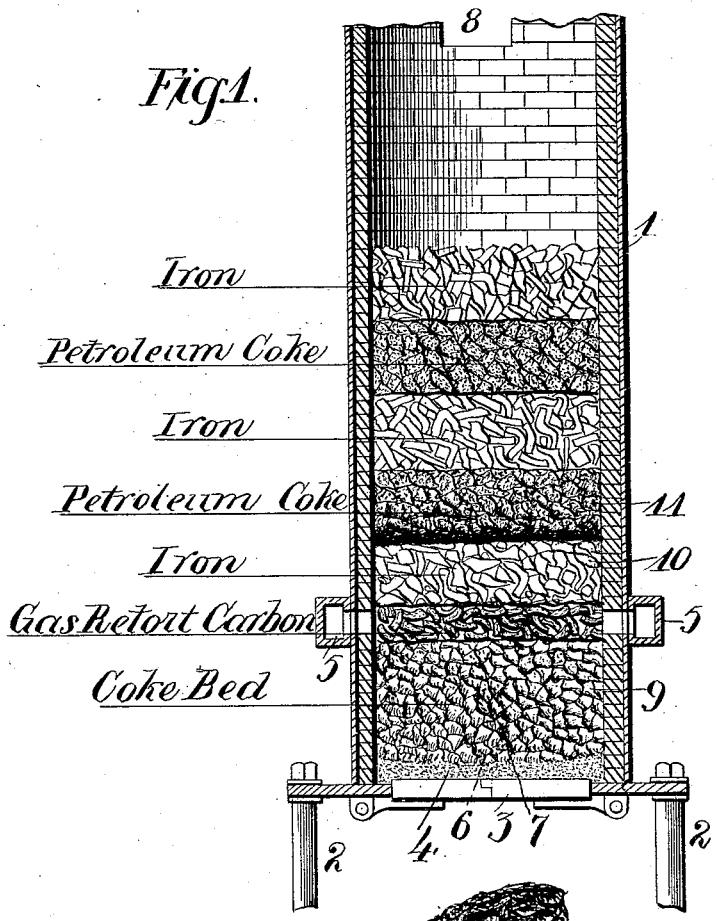
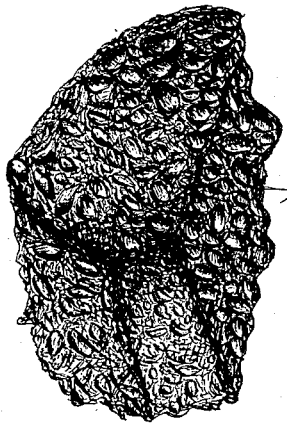


Fig. 2.



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PROCESS OF MELTING IRON.

SPECIFICATION forming part of Letters Patent No. 454,209, dated June 16, 1891.

Application filed September 10, 1890. Serial No. 364,515. (Specimens.)

To all whom it may concern:

Be it known that I, HENRY J. GRAF, a resident of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Processes of Remelting Iron in Cupola-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has for its object to provide certain improvements in the process of remelting iron in cupola-furnaces, and it especially relates to improvements upon the process described in Letters Patent No. 437,109, issued to me September 23, 1890; and it consists in the process of the arrangement of the material constituting the charge, as will hereinafter more fully appear, and be pointed out in the claim.

I will now proceed to describe more specifically the manner of carrying out my invention, and for facility in doing the same I have illustrated apparatus suitable therefor.

In the drawings which serve to illustrate my invention, Figure 1 is a vertical section of an ordinary cupola-furnace, and Fig. 2 is a perspective view of a detached and enlarged particle of petroleum-coke made use of in carrying out my invention.

Referring to the drawings, 1 represents the outer shell of an ordinary cupola, the same being provided with a suitable lining upon its interior and being mounted upon suitable iron columns or a base of masonry 2. This shell is provided with a drop-bottom 3, and in use should also have a sand-bed 4. Tuyeres 5, slag-hole 6, and tap-hole 7 are also provided in the usual manner, as are also a straight open-topped stack and a charging-opening 8. The direct or natural draft is used in starting the fire, as is usual in these cases.

My process of charging the furnace and the material employed therein is as follows: I first place a charge of ordinary coke 9 on the bottom of the furnace, which forms a base or stratum upon which the next adjacent stratum is adapted to rest. This bed stratum is then ignited and the blast is turned on. Then a thinner stratum of "gas-retort carbon," (commonly known as such in other usages,) is placed upon the coke stratum 9, said gas-retort carbon having previously been broken up to about what is known in the coal trade as "egg-size." After the charge of gas-retort carbon has been thrown into the furnace it is evenly distributed over the coke stratum, or it may be distributed properly during the process of throwing it in, thus giving it the best opportunity to ignite.

10 represents a charge of iron in the form of pig, scrap, or otherwise, scrap being preferred, as its cost is low and its quality will be improved sufficient for use in high-grade castings.

11 indicates a charge of petroleum-coke, which is placed in the form of a stratum above the iron. This petroleum-coke is the residue of oil-stills, that has been subjected to such a degree of heat that it is perfectly dry and exhausted of all volatile constituents of hydrocarbon, its name being derived from its origin and not from its contents.

I use petroleum-coke because it requires less blast than ordinary coke, keeps up a steady and high temperature, and improves the iron, so it can be used again for homogeneous work, and owing to the decrease in blast the iron is not subject to decarbonization, and as the coke carries a certain amount of moisture a decrease in the amount of coke will proportionally decrease the amount of hydrogen present in the furnace to be absorbed by the iron. Again, the iron is rapidly fused and heated far above its fusing-point, and when in such a state it is more applicable for foundry purposes, because it can remain in the ladles longer, and, being agitated with a rod before pouring into the mold, permits a free liberation of the dissolved gases. Furthermore, owing to the increase of temperature and carbon in the furnace, the iron is relieved from the many and various elements, as it deterges and facilitates reductions and combination.

The iron is rendered fluid, and the carbon is precipitated in the iron, which prevents the carbon from combining and leaves it wholly uncombined in its graphitic state.

Above the petroleum-coke is another layer of iron, and then one of petroleum-coke, then iron, and so on until the required amount of iron is melted.

By using petroleum-coke in connection with the other substances hereinbefore mentioned

I have found by experiments carried on in a full-sized cupola-furnace that the temperature, and consequently the fluidity, is increased, causing hard iron to become soft. It leaves the carbon wholly uncombined. It increases the quantity of the output, as it liberates every ounce of iron from the slag. It requires less blast and saves labor and fuel. It prevents decarbonization and keeps the iron gray in color and without a tendency to chilling. It leaves the iron open-grained and clean. It gives to it tenacity and improves low-grade iron, so it can be used for all purposes now demanding a high-grade iron, and, lastly, in molding it causes the iron to hold most of its carbon until the point of solidification, when a portion of the carbon is precipitated in graphitic form, assuming a coating in the mold and preventing the sand from adhering to the casting, leaving a clean and smooth casting not now attainable with the old methods in use.

By my process above described fifty per cent. less ordinary coke is required between charges of iron during the melting operation, and I have found that sixty-five per cent. less blast is required to accomplish the results aforesaid, and therefore heat will not be thrown out of the charging-opening of the furnace, as heretofore. About two per cent. of gas-retort carbon to one hundred per cent. of good scrap or pig iron is required, while about nineteen per cent. of the entire charge is petroleum-coke.

Having thus described my invention, what I claim is—

The hereinbefore-described process of melting iron in cupola-furnaces, which consists in charging a layer of gas-carbon upon ignited coke, charging alternate layers of iron and petroleum-coke upon the said gas-carbon, and passing a blast through the charge, as described.

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

HENRY J. GRAF.

Witnesses:
C. K. JONES,
E. E. LONGAN.