

UNITED STATES PATENT OFFICE.

JAMES J. FRONHEISER AND CHARLES S. PRICE, OF JOHNSTOWN, PENNSYLVANIA.

MANUFACTURE OF COKE.

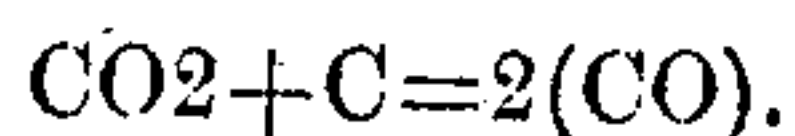
SPECIFICATION forming part of Letters Patent No. 486,100, dated November 15, 1892.

Application filed December 17, 1891. Serial No. 415,351. (No specimens.)

To all whom it may concern:

Be it known that we, JAMES J. FRONHEISER and CHARLES S. PRICE, citizens of the United States, residing at Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Manufacturing Coke; and we 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.

In the manufacture of coke from soft coal in retort-ovens, particularly in those constructed so as to save the by-products formed in the coking operation, the coke has the disadvantage of being more porous, softer, with more-easily crushed cell-walls than when the same coal is coked in the ordinary beehive-oven. This softer coke has the disadvantage of being easily acted on or dissolved, as it were, in the upper part of the blast-furnace and cupola by the carbonic-acid gas generated in the lower zones of the apparatus, which, taking up carbon from the coke, forms carbonic-oxide gas thus:



Owing to the property of the carbonic acid of being readily converted into carbonic oxide in this manner at the expense of the solid carbon of the coke it will require a greater quantity of such soft coke to furnish the same number of heat-units in the hearth of the blast-furnace or cupola than of the harder variety.

Now the object of our invention is to render the coke harder and denser, which we accomplish by first grinding the coal to a coarse powder and mixing it with a hydrate of lime (air or water slaked caustic lime) before it is charged into the coke-ovens.

We have found that quite a number of solid substances—such as limestone, blast-furnace spiegeleisen-slag, fusible clays, &c., the waste lime and fluoride-of-sodium mixture obtained in the manufacture of soda from cryolite, &c., or other solid matter suitable for a flux in the blast-furnace or cupola—will all answer this purpose. A suitable solid hardening substance is one which will satisfy part of the sulphur contained in the coal, will

unite with the free silica forming a silicate of the base, and by mechanical mixture will fill up the pores of the coke, thereby rendering it more dense. The advantage gained by the use of lime or other basic material is that the excessive quantity used will serve the purpose of uniting with the free silica in the blast-furnace or cupola charge to form a proper flux, and as substances containing any free silica will not do this it is not desirable to use them.

Among the reasons for preferring caustic lime is its cheapness as compared with that of other suitable materials and also its usefulness in the blast-furnace or cupola as a base to unite with the silica of the charge for the formation of a slag. While limestone or carbonate of lime in its different forms of combination may be used, they have the disadvantage that their carbonic acid eliminated in the process of coking acts on the carbon of the coal in the formation of carbonic oxide, thereby wasting part of the carbon of the coal.

In our practice we grind the coal by any of the well-known methods which will reduce it to a coarse powder. We then add to this mass a fluxing material, preferably caustic lime, either in a dry state or in a wetted and pasty condition, mixing the same thoroughly, after which it is charged into the coke-oven, as in the ordinary practice. There is an advantage in introducing into the cupola or furnace, in combination with the coke, a fluxing material such as is needed in the metallurgical operation carried on therein, and this is effected in our practice, as the caustic lime or other fluxing material used is mechanically combined with the coke, filling up its cell-walls. We find that about five per cent., by weight, of caustic lime mixed with the fine coal gives the best results. However, a larger quantity of lime can be added to coals containing more than five to seven per cent. of ash.

We are aware that in the manufacture of illuminating and heating gas, coal has been pulverized and mixed with lime to unite with the sulphur of the coal and with tar, naphtha, and other heavy hydrocarbons in order to increase its illuminating properties, in all of which coke is a by-product, and this we do not claim.

Having thus fully described our invention,

what we claim, and desire to secure by Letters Patent of the United States, is—

1. The process of manufacturing hard coke, which consists in pulverizing soft coal, mixing therewith a suitable hardening substance, charging the same into ovens, and heating them, substantially as described.

2. As a new article of manufacture, coke hardened by combining with it caustic lime or other suitable solid hardening substance in the process of its manufacture in such a man-

ner that the proportion of its cell-space to its cell-walls is diminished, giving to it greater density and firmness, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES J. FRONHEISER.
CHARLES S. PRICE.

Witnesses:

H. H. WEAVER,
H. L. BOYLE.