

UNITED STATES PATENT OFFICE.

HEINRICH KOPPERS, OF ESSEN-ON-THE-RUHR, GERMANY.

METHOD OF PREVENTING THE DESTRUCTION OF COKE-OVEN WALLS THROUGH THE ALKALIES CONTAINED IN THE CHARGE.

945,331.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, HEINRICH KOPPERS, a subject of the German Emperor, residing at Essen-on-the-Ruhr, in Germany, have invented a certain new and useful Method of Preventing the Destruction of Coke-Oven Walls Through the Alkalies Contained in the Charge, of which the following is a specification.

It is well known that the treatment of certain kinds of coal in coke-ovens is highly destructive to the walls of the ovens, more particularly at high temperatures. It has been found that the damaged walls and the pieces broken therefrom always contain a considerable quantity of easily fusible alkaline silicates, the presence of which has caused the bricks to become warped and to shrink and crack. The presence of these silicates is due to alkalies which are introduced with the charge and act on the silica contained in the walls. If the bricks used for making the walls are rich in silica, and not pressed, scales and patches become detached therefrom; pressed bricks rich in alumina become distorted. The alkalies referred to are soluble and insoluble salts, of which only small traces can be detected in the water dripping from the coal; this indicates that the said alkalies are intimately mixed with the coal.

The object of the present invention is to render the said alkalies harmless to the oven walls.

The alkalies present in the charge, usually chlorids, are decomposed by the heat, the acid (usually hydrochloric acid) being separated, and hydrates being formed with the water which is present, in the form of vapor, even at the higher temperatures. The acid reacts with the ammonia, forming so-called fixed ammonia, and the amount of fixed ammonia subsequently ascertainable may be taken as an indication of the amount of alkali introduced with the charge. In apparent contradiction to this view is the fact that the coking of certain kinds of coal is not accompanied by destruction of the oven-walls, though it results in the production of a large quantity of fixed ammonia. This is explained by the fact that the ash of such coal is rich in silica, with which the hydrates immediately react, so that the distilling or sublimation of the said hydrates is prevented.

The present invention is based on the observation referred to, and consists in adding to the coal the amount of silica in which it is deficient for binding the hydrates formed by decomposition of the alkalies. This prevents reaction of the said hydrates with the silica in the oven-walls, inasmuch as the tendency of the hydrates to react with silica is directly and immediately satisfied by the added silica.

The silica is preferably added in the form of sand, as being the simplest and cheapest form available.

Of the alkalies, earth alkalies and oxids of heavy metals present in the coal, and ascertainable in the ash, only the alkalies which are volatilized at red-heat, and flow with the gas from the center of the charge to the walls, are liable to injure the latter; the added silica serves more particularly for binding these alkalies. The amount of alkali which passes to the walls with the moisture is comparatively small, inasmuch as only the coal in direct contact with the walls gives off moisture to the latter. Most of the alkali remains in the charge, in the form of hydrate, until at the requisite temperature sublimation occurs and the hydrate is bound with the excess of silica.

The quantity of ashes of coking coal averages about 6-8 per cent, and contains silicates, the composition of which varies greatly with the nature of the coal. Some ashes are basic, while others are acid. The following table gives the analysis of the ashes of a coking coal, showing also the amount of silica necessary for binding the bases:

Al ₂ O ₃	24.83%	requires for binding	22.00%	SiO ₂	95
FeO ₃	26.93%	"	15.20%	"	
CaO	6.71%	"	3.60%	"	
MgO	1.31%	"	0.97%	"	
K ₂ O	4.80%	"	1.54%	"	
SiO ₂	35.42%	"	43.31%	"	
Present in the coal.....				35.42%	100
Necessary to be added..				7.89%	"

If the coal contains 6% ashes, 0.47% SiO₂ are thus to be added to said coal. But in order to insure a combination of all the bases with the silica, a slight excess of the latter should be used. Thus, about 1-2% of sand are added to the coal which should be thoroughly intermingled therewith.

What I claim as my invention and desire

to secure by Letters Patent of the United States is:—

Method of preventing the destruction of coke oven walls through the alkalies contained in the charge, which consists in adding to the coal a quantity of silica sufficient to bind the excess of alkalies contained in the coal and which remains uncombined by reason of the insufficient quantity of silica naturally carried by the coal, thoroughly intermixing the coal and the added silica,

and coking the mixture in a coking chamber having silicious walls, the addition of the silica to the coal preventing the extraction of the silica from said walls. 15

In witness whereof I have signed this specification in the presence of two witnesses.

HEINRICH KOPPERS.

Witnesses:

R. GUNDERSON,
JOHN H. GARNSEY.