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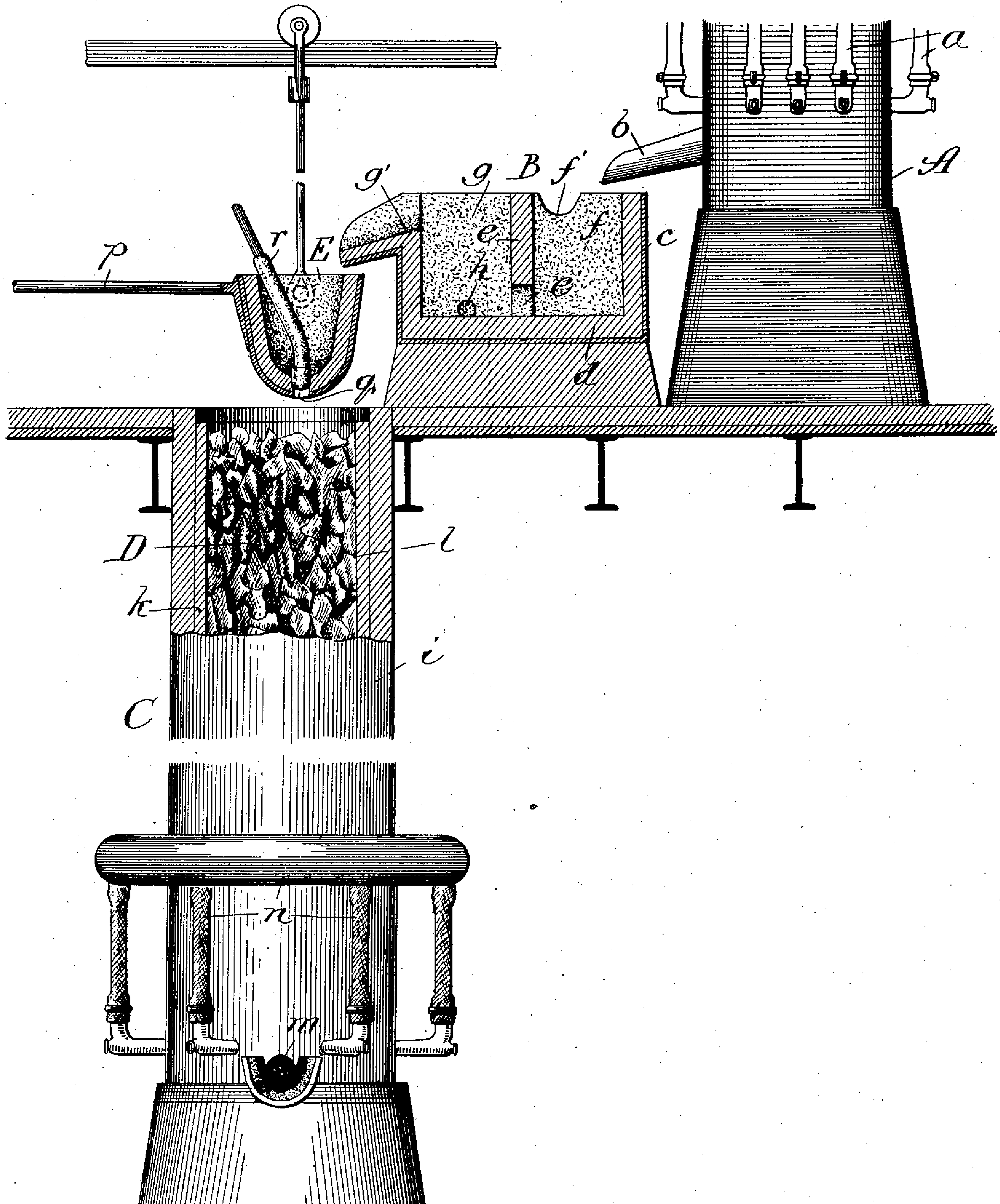
W. A. KÖNEMAN.

METHOD OF CARBURIZING IRON.

APPLICATION FILED SEPT. 2, 1902.

NO MODEL.



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No. 740,025. Patented September 29, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM A. KÖNEMAN, OF CHICAGO, ILLINOIS.

METHOD OF CARBURIZING IRON.

SPECIFICATION forming part of Letters Patent No. 740,025, dated September 29, 1903.

Application filed September 2, 1902. Serial No. 121,810. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM A. KÖNEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in the Method of Carburizing Iron, of which the following is a specification.

This invention relates to an improved method of carburizing iron or iron-bearing compounds which are low in or devoid of carbon, and is in the nature of an improvement upon the method described in Letters Patent No. 485,392, granted to me November 1, 1892.

The object of my present invention is to provide an improved method of incorporating carbon into iron, whereby steel or wrought-iron scrap, tin-scrap, malleable-iron scrap, and the like may be converted into cast-iron having a more or less high percentage of carbon, thus rendering the iron of comparatively high grade having good tooling qualities. I have found in the practice of my former method of carburizing or recarburizing, employing the apparatus shown in my aforesaid patent, that it is objectionable to utilize the carbonaceous fuel both for melting and carburizing the iron, because the fuel is apt to reach the carburizing zone in a decrepit and partially-consumed condition. I have also found it undesirable, as practiced in my former method, to introduce slag or material which will form slag into the carburizing portion of apparatus devised for practicing the method. I overcome the aforesaid objections to the method as described in my patent cited by separating the single operation described therein into two separate operations, one following the other, in two separate independent apparatus. In other words, instead of melting the iron and carburizing it in the same apparatus I first melt the mass in a cupola or other suitable furnace, then, if necessary, run off or otherwise remove the slag formed during fusion from the metal, and then pass or filter the clean or cleansed molten iron downward through a column of incandescent carbonaceous fuel, maintained incandescent by a supply of oxygen, permitting the metal to percolate through the same, and withdraw it from the base of the column. The iron during its downward percolation is subjected to gradually-increasing temperature, so that when it reaches the discharge-outlet at the base of the column it has attained the maximum temperature and may be immediately utilized without reheating for making commercial castings.

The accompanying drawing is a broken view showing apparatus of a form suitable for carrying out my present invention.

A is a cupola, which may be of any suitable construction, *a* being the twyers and *b* the outlet-spout.

B is a separator comprising a metal casing *c*, lined with fire-brick or other refractory material *d* and having a partition *e* of the same material extending from the top more or less nearly to the bottom, leaving a passage *e'*. Thus the vessel is separated into two compartments *f* and *g*. At the top of the chamber or receptacle *f* is a slag-overflow outlet *f'*, and in the receptacle *g* toward the top is a metal-outlet *g'*, having the spout shown. At the base of the separator is an outlet *h*, which may be plugged in a common manner to close it.

C is a carbon filter or carburizer comprising a shell *i*, having a thick lining *k*, of fire-brick or the like, surrounding the filter-shaft *l*, which is open at the top, or may be provided with a suitable gas-offtake. The carburizer has an outlet *m* near its base, and, as shown, it has a blast-pipe *n* and twyers for conducting an air-blast into the lower part of the shaft. In practice the shaft *l* is filled with coke, anthracite coal, or other suitable carbonaceous material, and the entire carbon mass or column D is raised to and maintained at a more or less highly incandescent temperature by an air-blast or by any other suitable means. The iron or iron compound to be carburized is fed to and melted in the cupola or furnace A and when fluid is run out at the tap or spout *b* into the separator B. Any slag formed during fusion from the metal, which slag is of less specific gravity than the iron, will tend to rise as the mass is poured into the compartment *f*, being trapped against entering the compartment *g* by the partition *e*. Thus as the separator fills the slag will overflow at the outlet *f'* into a ladle or other suitable vessel which may be provided to receive it, and the metal only will escape at the spout *g'*. The molten iron is poured upon the top of the carbon column D, which is maintained incandescent by the supply of oxygen, as described, and the iron is caused to filter or percolate downward through the carbon and its gaseous products and escape at the outlet *m*. In its passage through the incandescent column the iron takes up carbon, which becoming incorporated with the metal softens it in the manner well known.

It is desirable that the molten iron from the furnace or separator shall be distributed as evenly as possible over the entire top of the carbon column to avoid its forming a channel through the column, as it would if poured upon one spot only. I therefore provide a distributer, which, as shown, may be a swinging suspended ladle E, having a handle *p* and a small opening *q* in its base. The opening *q* may be opened and closed by means of a plug *r*, having a handle extending past the top of the ladle, as shown. In each operation the furnace A is tapped to permit enough iron to pass to the ladle E to fill the same. The plug *r* is then raised to open the orifice *q*, and the ladle is swung back and forth in all directions over the top of the column D to distribute the iron as it flows from the opening *q* as equally as possible over the column. The column D of incandescent carbon is of comparatively great depth. I have found, for example, that the percolation of molten iron initially substantially devoid of carbon through a carbon column D approximating twenty-five feet in depth produces iron containing about three per cent. of carbon, whereas a column D approximating thirty-six feet in depth will raise the percentage of carbon in iron of the same character passing through it to three and a half per cent. and upward. Inasmuch as the function of the carbon column or filter is to impart carbon to molten iron poured upon it, practically no carbon will be consumed in imparting sensible heat to the metal in order to fuse the same. The carbon shrinkage in the column during operation will be the per cent. thereof imparted to the iron plus the amount consumed in the production of heat which may be lost by radiation or convection through the shell plus the escaping carbonic oxid. When a blast is alone employed to maintain the column incandescent, it is attended naturally therefore with a certain amount of waste of the carbon. When a blast alone is employed, as indicated in the drawing, it should be regulated by suitable means to be sufficient only to maintain the column incandescent without effecting any more waste of carbon than necessary. The wall or shell of the filter or carburizer C should be sufficiently thick to avoid radiation of the heat as much as possible. I have found in practive that even when a blast is employed the consumption of carbon in the curburizer during operation need not exceed five per cent. per ton of iron treated.

As is well known, much of the low-grade iron-scrap which may be treated by this method contains more or less sulfur. In treating such metal by this method I prefer to add from five to forty pounds of calcium chlorid per ton of iron to the metal poured upon the column, which calcium chlorid under the action of the sulfur sets free chlorin gas, which, as is well known, will likewise attack and eliminate many other volatile impurities. The calcium contained in the calcium chlorid forms an especially suitable flux for the ash contained in the coke, anthracite, or other carbon employed to make up the column D, and any shortage of calcium may be provided by the addition of limestone or lime in some other form. As carbon is consumed the column of fuel will naturally sink, and it is maintained at the desired level by additions of the same carbonaceous material, made from time to time.

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

1. The method of carburizing iron or iron-bearing compounds, which consists in pouring the same in a molten state upon a comparatively deep column of incandescent carbonaceous material, effecting the continuous percolation of the iron through said column, and introducing oxygen into said column during such percolation, whereby the iron in its state of fine division and while descending is subjected to the carburizing effect of the carbon mass and the gas continually generated in said mass.

2. The method of carburizing iron or iron-bearing compounds, which consists in melting the same, separating the iron from slag formed during such melting, then pouring the cleaned iron in a molten state upon a comparatively deep column of incandescent carbonaceous material, effecting continuous percolation of the iron through said column and introducing oxygen into said column during such percolation, whereby the cleaned iron in its state of fine division and while descending is subjected to the carburizing effect of the carbon mass and to gas continually generated in said mass.

3. The method of carburizing iron or iron-bearing compounds, which consists in melting the same, then distributing the iron in a molten condition over the entire surface of a comparatively deep column of incandescent carbonaceous material, effecting continuous percolation of the iron through said column, and introducing oxygen into said column during such percolation, whereby the iron in its state of fine division, and while descending is subjected to the carburizing effect of the carbon mass and the gas continually generated in said mass.

WILLIAM A. KÖNEMAN.

In presence of—
ALBERT D. BACCI,
W. B. DAVIES.