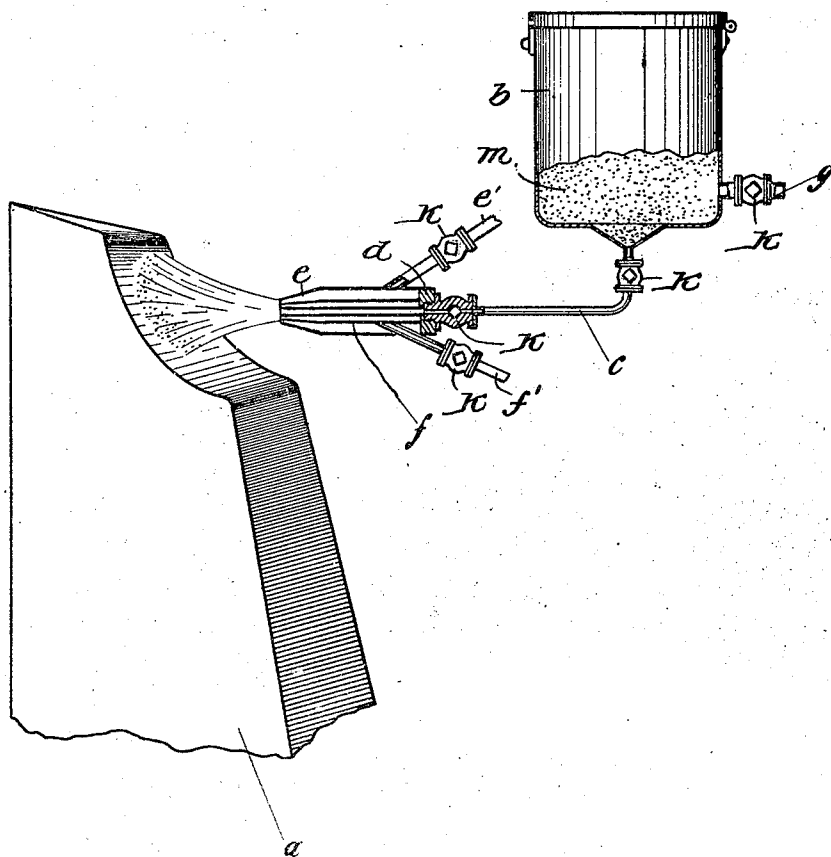


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CEMENTATION AND HARDENING OF IRON AND STEEL ARTICLES.
APPLICATION FILED JULY 31, 1915.

1,178,551.

Patented Apr. 11, 1916.



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UNITED STATES PATENT OFFICE.

GEORG STOLLE AND ALFRED HOCKS, OF KIEL, GERMANY.

CEMENTATION AND HARDENING OF IRON AND STEEL ARTICLES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, GEORG STOLLE and ALFRED HOCKS, subjects of the German Emperor, and residing at Kiel, Germany, have invented certain new and useful Improvements in Cementation and Hardening of Iron and Steel Articles, of which the following is a specification.

This invention relates to a method of effectively employing the surface treatment of iron and steel articles for the purpose of improving their quality and more particularly to the cementation or hardening of iron.

As is well known the cementation or hardening of iron is usually effected by case-hardening, viz. by embedding the article in the case-hardening material and heating the whole to incandescence in a special furnace. The packing of the article in the case-hardening material and the subsequent heating to incandescence and cooling of the whole mass of iron takes up much time. In many cases also owing to the form and weight of a particular article it is difficult or impossible to insert it into the furnace.

The object of the invention is to overcome these drawbacks and to provide a hardening process in which packing of the article in material and heating the whole piece is avoided.

A further object of the invention is to simultaneously effect in the use of the process improvements in the quality of the metal other than hardening and in fact such other improvements in quality may in some cases form the sole object of the process.

The invention consists of a method for locally heating the article and simultaneously spraying suitable material onto the heating region.

Our invention will be best understood by reference to the following description in connection with the accompanying illustration of one specific embodiment thereof.

The drawing shows in vertical section suitable apparatus by means of which our invention may be effectively carried out, parts of such apparatus being shown in side elevation.

We have there represented a piece *a* that is to be treated and at right of said piece is indicated in partial transverse section a device for carrying out the process.

b is a covered reservoir filled with the pulverulent hardening material *m*, and the

bottom of which is connected, by means of a conduit *c*, with a gas blow-pipe *d*. The gas-blow pipe *d* consists of two tubes *e* and *f* one of which surrounds the other and the end of the conduit *c*. The outer tube *e* is in communication with a conduit *e'* for compressed air or gas while the tube *f* which surrounds the end of the conduit *c* and is itself surrounded by the tube *e*, communicates with a conduit *f'* for the heating gas. The conduits *e'* and *f'* as well as the conduit *c* are provided with suitable cocks *k*. The vacuum produced by the stream of fluid or by the flame flowing from the tubes *e* and *f* of the gas-blow pipe *d* causes the material *m* to be sucked off from the conduit *c* and sprayed on to the heated region of the surface of the piece *a*. For the purpose of stirring up the material *m* contained in the reservoir *b* and preserving the conduit *c* from obstruction a conduit *g* for compressed air or gas is connected to the reservoir *b* near its bottom, said conduit being also provided with a suitable cock *k*.

In carrying the invention into effect, for example in hardening iron, the cocks *k* of the conduits *e'* and *f'* are opened and the stream of fluid flowing from the gas-blow pipe *d* is lighted. The piece *a* is moved past the flame of the gas-blow pipe *d* by any suitable means (not shown) and heated to red heat over that portion of the surface which it is desired to harden.

After the piece *a* has attained the desired color over that portion of the surface which it is desired to harden the cock *k* of conduit *c* is opened and pulverulent carbon in any suitable form, such for example as pure carbon, binary, or ternary, or higher alloy of nickel, chromium, vanadium, tungsten molybdenum and the like, is sucked off from the reservoir *b* by the compressed air or gas current and simultaneously sprayed on to the heated region. The cock *k* of the compressed air conduit *g* is opened at the same time as cock *k* of conduit *c*. Once the desired degree of hardness is obtained, all of the cocks *k* are closed. The carbon may also be carried through the source of the heat and sprayed on to the article by a current of compressed air or gas capable of regulation. Furthermore a gas mixture may be conducted under pressure to be projected on to the heated surface of the iron hardened. By a suitable regulation of pressure and of gas or air supply or both,

the resulting imperfect combustion of the gas may be made to produce a deposit of carbon.

When it is desired merely to improve the
5 quality, for example of an article made of iron containing already in itself a sufficiently high percentage of carbon, then the material sprayed on to the metal may consist of metals or metallic alloys having a
10 low percentage of carbon or free from carbon. Such material as boron and silicon or their compounds may also be used.

The source of heat used for heating the portion of the surface to be treated may be
15 a flame fed with suitable combustible material either solid or fluid or in the form of gas or vapor.

What we claim is:—

1. The method of improving the quality
20 of iron and steel articles by surface treatment which consists in the application of means for locally heating the article and simultaneously spraying suitable material on to the heated region by means of said
25 heating means.

2. The method of cementation or hardening for an article constructed of iron or steel which consists in subjecting a portion of the surface of said article to a heating
30 medium, and in locally applying suitable

hardening material by means of said heating medium.

3. The method of improving the quality of iron and steel articles by surface treatment, which consists in locally heating the
35 article with a heating flame and simultaneously spraying suitable material on to the heated region, by means of said flame.

4. The method of cementation or hardening for an article constructed of iron or
40 steel which consists in subjecting the iron or steel to the heating effects of a heating medium, and in the local application of hardening material to the heated iron or steel by means of said heating medium. 45

5. The method of surface treatment of iron and steel articles already containing a sufficiently high percentage of carbon which consists in the application of means for
50 locally heating the article and simultaneously spraying on to the heated region by said heating means metals, metallic-alloys or other suitable material.

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

GEORG STOLLE.
ALFRED HOCKS.

Witnesses:

JULIUS RÖPKE,
WILHELM KRÜTZFELDT.