

UNITED STATES PATENT OFFICE.

WILLIAM RICHARD HODGKINSON, OF BLACKHEATH, ENGLAND.

TREATMENT OF IRON OR STEEL.

946,360.

Specification of Letters Patent. Patented Jan. 11, 1910.

No Drawing.

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To all whom it may concern:

Be it known that I, WILLIAM RICHARD HODGKINSON, a subject of the King of Great Britain, residing at 18 Glenluce road, Blackheath, in the county of Kent, England, have invented certain new and useful Improvements in or Relating to the Treatment of Iron or Steel, of which the following is a specification.

This invention relates to the treatment of iron or steel and has particular reference to the carburizing or case-hardening of iron or mild steel, the chief object being to enable this result to be attained in a simple, rapid and effective manner and to avoid the liability of the iron or steel, or article composed thereof, becoming deformed or otherwise rendered defective by being raised to an excessively high temperature.

According to this invention the iron or steel is heated to an appropriate temperature in contact with or in an atmosphere of a mixture of acetylene and ammonia gases.

In carrying the invention into practice the iron or steel is placed in a muffle or similar chamber which is heated to the desired temperature and the gaseous mixture of acetylene and ammonia is passed into the said chamber, or materials which will yield the gaseous mixture are introduced directly therein. Thus, calcium carbide may be added to a strong ammonia solution in which case a mixture of the two gases, ammonia and acetylene, is produced, or a mixture of calcium carbide and ammonium chloride may be introduced into the heated chamber, the reaction which takes place in the latter case being represented by the following equation:—



The component gases of the gaseous mixture are preferably in about the proportion of two volumes of ammonia to one volume of acetylene. Any other proportions may however be employed, the only objection to proportions different from those above stated being that the excess of one or other of the gases is to some extent wasted; a rough indication of appropriate proportions for the gases is given by the flame of the mixture when ignited, which should be luminous but not very smoky. The gaseous mixture although combustible is not dangerous nor self-explosive, so that no risk is incurred in its employment.

I would here remark that acetylene alone will carbonize iron or steel, but in so doing much acetylene is merely decomposed and much carbon deposited whereas its admixture with ammonia prevents or checks mere decomposition of the acetylene or deposition of carbon in the form of soot. It is probable that cyanogen is formed and afterward decomposed, as it has been found that the iron or steel after treatment contains some nitrogen.

The steel produced by this process is much harder than ordinary case hardened steel without chilling and the metal is hardened to a much greater depth in a given time. In appearance it is, under the microscope, of fibrous or net like structure as distinguished from the granular structure of ordinary case hardened steel. This fibrous structure is not always apparent in chilled steel but the characteristic appearance can be readily brought out by heating to a high temperature and allowing it to cool slowly.

The rate at which the iron or steel is being carburized or case-hardened can be ascertained and controlled by examining trial pieces, or by regulating the temperature or time of exposure. Thus, iron at a temperature of about 360° C and exposed to the gases for three or four hours will become carburized to about an equal extent if exposed for about ten minutes when the iron is heated to 1000° C. As a further example, it may be stated that a bar of mild steel of one half a square inch in sectional area and containing .04% of carbon when exposed to the gaseous mixture for thirty minutes at a temperature of from 500° to 600° C, is carburized to the hardness of steel containing about 1% of carbon.

When the result of the examination of test pieces indicates that the reaction is complete the iron or steel is removed from the furnace and applied to the various purposes for which case-hardened or carburized iron or steel is preferable or essential, as for example in the construction of armor plates.

What I claim and desire to secure by Letters Patent of the United States is:—

1. The process of carburizing or case-hardening iron or steel which consists in subjecting the same, in a heated condition, to the conjoint action of acetylene and ammonia gases.

2. The process of carburizing or case

hardening iron or steel which consists in
subjecting the same, in a heated condition,
to a mixture of acetylene and ammonia gases
such that upon ignition the resulting flame
5 is luminous but not very smoky, substan-
tially as described.

3. The process of carburizing or case
hardening iron or steel which consists in
subjecting the same, in a heated condition,
10 to a mixture of acetylene and ammonia gases
the proportion of said gases being substan-
tially one part acetylene to two parts am-
monia gas, substantially as described.

4. The process of carburizing or case
hardening iron or steel which consists in 15
subjecting the same at a temperature suffi-
ciently high to normally decompose acety-
lene gas, to a practically non-explosive mix-
ture of acetylene and ammonia gases.

In testimony whereof I affix my signa- 20
ture in presence of two witnesses.

WILLIAM RICHARD HODGKINSON.

Witnesses:

ARTHUR H. COOTE,
RALPH M. SAW.