

UNITED STATES PATENT OFFICE.

ROBERT ABBOTT HADFIELD, OF SHEFFIELD, ENGLAND.

STEEL.

SPECIFICATION forming part of Letters Patent No. 786,561, dated April 4, 1905.

Original application filed June 18, 1904, Serial No. 213,131. Divided and this application filed August 13, 1904. Serial No. 220,649.

To all whom it may concern:

Be it known that I, ROBERT ABBOTT HADFIELD, a subject of the King of Great Britain, and a resident of Sheffield, in the county of York, England, have invented certain new and useful Improvements in Steel, of which the following is a specification.

My invention relates to the manufacture of steel, and particularly to steel intended for structural and other purposes in which it is desirable to employ material of high tenacity, very high elastic limit, great ductility and toughness.

My present application is a division of an application for United States Patent filed by me on June 18, 1904, Serial No. 213,131.

I have found that steel possessing in a very high degree the desirable properties mentioned above can be made by using carbon, manganese, nickel, and chromium in proportions within certain limits, as stated below in detail.

A typical example of my steel contains .44 per cent. of carbon, .32 per cent. of manganese, 3.5 per cent. of nickel, and 1.71 per cent. of chromium. The proportions may be varied within certain limits. Thus the carbon may vary from about .3 per cent. to about .6 per cent., the chromium from about one per cent. to about three per cent., and the nickel from about two per cent. to about five per cent. The percentage of manganese may also be varied, but should be kept low, so as not to exceed, say, .25 or .3 per cent.

The steel may be produced in various manners, as by the open-hearth process or in a crucible.

Steel of the composition above set forth has a high tenacity and a very high elastic limit, yet remarkable ductility and toughness. These valuable properties may, if desired, be enhanced by means of special treatment, such as described in my application for patent hereinafter mentioned, one instance of such treatment being as follows: The steel is heated carefully to a temperature between about 750° and 850° centigrade, preferably 785° centigrade, and quenched in oil. Then the steel is reheated to a temperature between about 620° and 630° centigrade and quenched in water. When so treated, the steel has an elastic limit of over one hundred thousand pounds per square inch and a tensile strength of over one hundred and ten thousand pounds per square inch.

Another method of treatment is as follows: The steel is carefully heated to a temperature of 710° centigrade and quenched in oil. Then the steel is reheated to 620° centigrade and quenched in water.

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

The herein-described steel containing carbon, manganese, nickel and chromium in about the proportions specified (the percentage of manganese being low) and possessing a high elastic limit and a high tenacity with great ductility and toughness.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT ABBOTT HADFIELD.

Witnesses:

WILFRED H. SLATER,
CHAS. N. DANIELS.