UNITED STATES PATENT OFFICE.

ELLIOT SAVAGE, OF WEST MERIDEN, CONNECTICUT, ASSIGNOR TO HIMSELF AND GEO. S. HARWOOD AND GEO. H. QUINCY.

IMPROVED PROCESS FOR CONVERTING IRON INTO STEEL.

Specification forming part of Letters Patent No. **52,796**, dated February 20, 1866.

To all whom it may concern:

Be it known that I, ELLIOT SAVAGE, of West Meriden, in the county of New Haven and State of Connecticut, have invented certain new and useful improvements in the method of tempering and hardening steel and of treating iron for the purpose of converting the same into steel or a substance resembling steel; and I hereby declare that the following is a full, clear, and exact description of the same.

My improvements relate to the treatment of iron, steel, and other metals, as it regards the heating, for the purposes of hardening and tempering and of changing the physical properties of the same with respect to the texture and otherwise.

The old methods are so well understood by experts that it is not necessary here to describe them; but I will premise by stating that I have heretofore discovered that by heating steel in a bath of cyanide of potassium and by then immersing it in a solution of silver or other metallic solution the silver or other metal of the said solution will be precipitated on and adhere to the surface of the steel, and thus form a plating which offers several important advantages over the old method of electroplating. Recent experiments, however, have led to the discovery that the heating of the steel in cyanide of potassium is of greatest importance when used in connection with the process of tempering for which Letters Patent of the United States were issued to me on the 13th day of June, 1865. The invention subject of that patent has reference to the cooling only, independently of the method of heating, which necessarily precedes the cooling, and although good results are obtained, yet they are greatly enhanced, for the reasons hereinafter set forth, by the preliminary heating in a bath of cyanide of potassium, and I have further discovered that other metals, such as wrought-iron or cast-iron, are more or less changed in their nature and converted into a steel-like substance if heated in like manner, excepting as to the time of immersion in the fused mass of cyanide of potassium, which is variable according to the metal worked upon and the effect sought to be produced. Thus for the purpose of heating I use a bath of fused cyanide of potassium or any other substance free from oxygen fusible by heat. This substance is heated to redness in a crucible or retort, and in this fused bath I place the metal on which I propose to operate. Having allowed the metal to remain in this fused bath as long as desirable, I remove it and immediately submerge it in a cooling-bath, for which purpose I prefer a metallic solution. I have found solutions the metallic base of which is copper or silver to be the best; but I do not confine myself to these metals.

What I accomplish by these means is as follows: In the case of wrought-iron I convert the surface into steel, and the extent to which this conversion is carried depends upon the length of time the metal remains in the fused bath. I am thus enabled to produce the effects of case-hardening on malleable iron to any given depth and in less time than is required by any other process. In the case of cast-iron the result of my process is to change its granular structure to a condition approximating to a fibrous structure, thus greatly increasing its tenacity, and at the same time, when suddenly cooled, to give it a great degree of hardness, equal or nearly so, to that of steel under similar treatment, thus giving to it the properties of steel. In the case of steel I heat it by this process for the purpose of preserving the surface from oxidizing, and for the convenience of heating many articles of irregular shape, the parts of which are of unequal thickness and the thin parts of which are liable to be overheated by the old process, and consequently to warp when immersed in the cooling-bath. By this process the heat is equally diffused throughout the submerged mass.

Having thus described my invention, I claim—

1. The improved method of hardening and tempering steel by heating the same in cyanide of potassium previous to its immersion in a cooling-liquid.

2. The improved mode of treating iron for the purpose of producing upon it the effects of case-hardening by heating the same in a bath of cyanide of potassium and by submerging it in a cooling-liquid.

3. The improved mode of treating cast-iron for the purpose of converting it into steel or a substance resembling steel by heating the same in a bath of cyanide of potassium and submerging it in a cooling-liquid.

4. In the method of treating iron, steel, and other metals by means of cyanide of potassium, as and for the purposes hereinbefore set forth, the use of metallic solutions as the cooling-liquid.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

ELLIOT SAVAGE.

Witnesses:
WM. H. SWEETSER,
WM. J. QUINCY.