# UNITED STATES PATENT OFFICE.

ELLIOT SAVAGE AND HENRY STRATTON, OF WEST MERIDEN, CONN.

## IMPROVEMENT IN HARDENING AND TEMPERING STEEL.

Specification forming part of Letters Patent No. **48,213**, dated June 13, 1865.

*To all whom it may concern:*

Be it known that we, ELLIOT SAVAGE and HENRY STRATTON, both of West Meriden, New Haven county, Connecticut, have invented certain new and useful Improvements in Hardening Steel; and we do hereby declare that the following is a full, clear, and exact description of the same.

This invention or discovery is an improvement in the art of hardening steel, whereby any piece or article of steel may be hardened or tempered to any degree required at such low temperatures of the preliminary heating that the shape or configuration or finish of the most delicate or complicated character is not altered, preserving also at the same time the requisite tenacity. The principle upon which these results are effected lies in the employment of solutions, in which to immerse the heated steel, which possess a very high degree of conducting character for heat, so that the utmost rapidity in the cooling will be attained, for in this the true theory of the operation appears to be involved.

We have discovered that metals having the greatest conducting power for heat, and which can be held chemically in solution, constitute those solutions media whereby results may be attained in the art of hardening steel which have been wholly unattainable hitherto. Thus solutions of gold, silver, copper, &c., are employed by us, and the results obtained are in the direct ratio of the respective conducting powers of the metals and the specific gravity of the solution. Silver possesses the highest conducting power, but the specific gravity of any solution of that metal is limited to a degree less than that of copper, which is next in order, but which possesses the property of being held in solution to a much greater density, thereby rendering it for many articles equal to silver, while it has also the advantage of cheapness. We prefer to prepare these solutions from a metal in the form of a chloride, since it is then free from acid and can be readily dissolved in a proper fluid; but they may be in the form of sulphates, as the sulphate of copper, &c.

The process, then, will be as follows: For very fine articles—such as engraved bank-note plates of steel—a silver solution is to be preferred. Of this take the chloride and dissolve it in a solution of cyanuret of potassium in water, or of water of ammonia, until it has the strength of about ten degrees of Baumé's hydrometer, observing, however, that the greater the specific gravity the lower the temperature at which the steel may be at the moment of immersion, and consequently the risk of change of shape or of fracture is lessened accordingly. If the solution is to be of copper, dissolve in a vat containing water chloride of copper until, by trials, the proper specific gravity is obtained. As soon as the temperature of the steel has been raised sufficiently for the purpose, plunge it suddenly into the liquid, and let it remain to cool.

An experienced operator can always proportion the strength of the liquid to the article to be hardened, and also determine the right temperature the steel must have attained in the fire before immersing it in the solution to secure the exact degree of hardness. If it should happen that the steel had been made too hard the temper can be drawn by any of the usual methods.

It has been remarked above that the chlorides are preferable on account of being free from acid. Solutions, however, prepared from sulphates or other oxysalts should have their acid neutralized before immersing the steel, to prevent the surface of the steel from being attacked by the oxygen.

We claim—

The use or employment in hardening steel of metallic solutions in the manner and for the purpose substantially as set forth.

In witness whereof we have hereunto subscribed our names.

ELLIOT SAVAGE.
HENRY STRATTON.

Witnesses:
ARTHUR G. RIX,
GEORGE A. FAY.