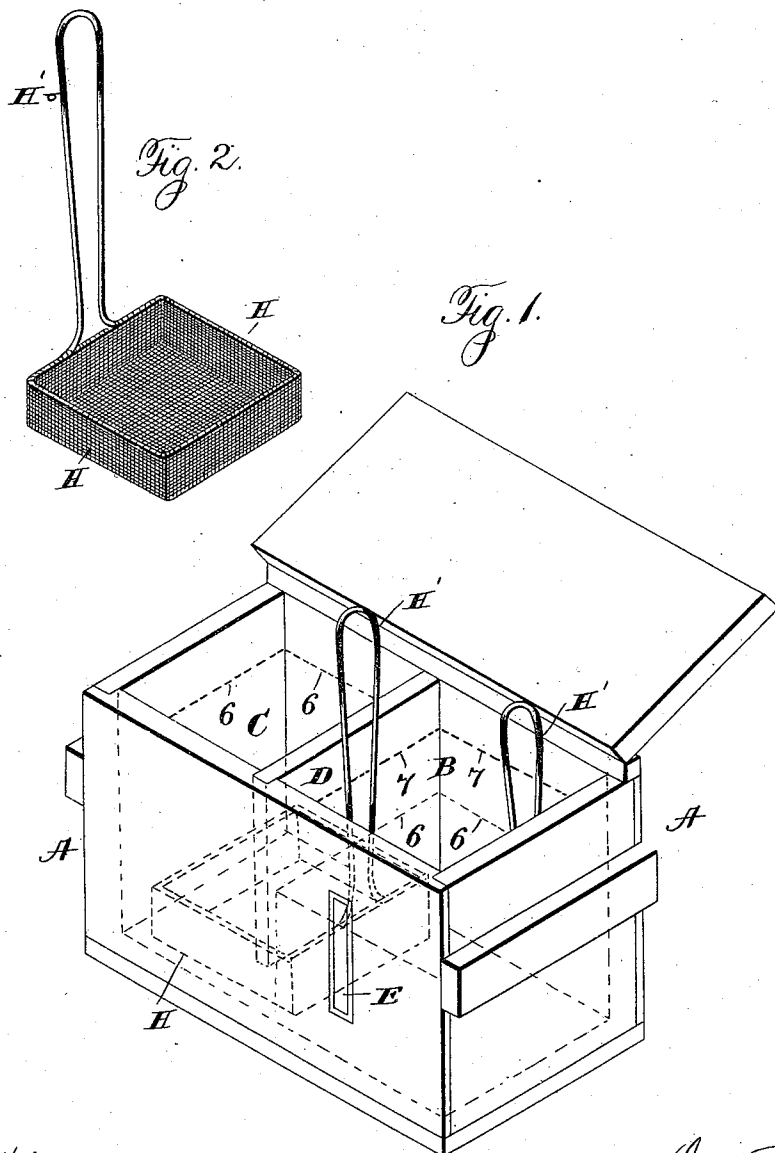


(No Model.)

G. F. SIMONDS.
PROCESS OF HARDENING STEEL.

No. 466,442.

Patented Jan. 5, 1892.



Witnesses:
Jas. C. Hutchinson.
J. A. Rutherford.

Inventor:
George F. Simonds,
By James L. Norris,
Attorney

UNITED STATES PATENT OFFICE.

GEORGE F. SIMONDS, OF FITCHBURG, MASSACHUSETTS.

PROCESS OF HARDENING STEEL.

SPECIFICATION forming part of Letters Patent No. 466,442, dated January 5, 1892.

Application filed August 22, 1891. Serial No. 403,459. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. SIMONDS, of Fitchburg, in the county of Worcester and State of Massachusetts, have invented a new and useful Improvement in Processes of Hardening Steel, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to processes of hardening steel.

The purpose of the invention is to harden steel without subjecting it to undue and unequal strains in the process of cooling, thus avoiding fracture and warping of the parts.

The purpose of the invention is also to improve the quality of articles treated.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same in connection with the accompanying drawings, in which I have illustrated one form of apparatus by which said invention may be practiced.

In the said drawings, Figure 1 is a perspective view of a box containing the bath in which the articles are cooled, and Fig. 2 is a perspective of a wire basket by which the treated articles are handled when this bath is used.

In Fig. 1, A is a box or tank, the inside of which is divided into two compartments B C by the partition D, which extends about two-thirds of the distance from the top to the bottom of the box, thereby forming at the bottom of the box an open communication between the compartments B C.

E is a sight-opening in the box in the front side of compartment B, provided with glass, for the purpose of observing the line of demarcation between the brine and the oil floating upon it in compartment B. As the specific gravity of oil is less than that of brine, with this apparatus I am able to keep the compartment C nearly full of brine and compartment B full to a line above the bottom of partition D, with such a depth of oil on top of the brine in compartment B as may be desired, for purposes hereinafter specified, the brine in both compartments and the supernatant oil in the said compartment B being indicated in Fig. 1.

It is often desirable in hardening steel to cool the article treated with great rapidity to

make it very hard and then complete the process by cooling more slowly to prevent quick and uneven contraction and fractures. This is sometimes done by cooling in a vat of brine and then transferring the partially-cooled article through air into a basin of oil; but this method is very objectionable, as the good effects of the process of cooling, first in brine and then in oil, are greatly diminished by the interruption of the process by the transfer through the air or some other intermediate medium in passing from the brine to the oil. To obviate this difficulty I proceed as follows: The basket, H (shown in Fig. 2,) formed of wire and provided with a vertical handle H', rising from one of its sides, is passed down through the oil and into the brine in compartment B, as shown in Fig. 1, with the handle B' of the basket standing in close proximity to the outer end of the compartment, as shown in Fig. 1. The basket, which rests upon the bottom, is then moved under partition D, so as to rest on the bottom of compartment C, in which position it will substantially fill the bottom of the compartment C, with its handle rising close to the partition D, as indicated by full lines in Fig. 1. The heated articles to be hardened are then dropped into the basket in the brine, and the basket is removed to compartment B and lifted up through the brine into the oil floating upon the surface of the brine, where the process of hardening is completed. The articles are allowed to cool in the brine or in the oil for such time as may be desired to produce the best results, according to the circumstances of each case. By these means the process of tempering is completed without any interruption, as the articles under treatment are removed from the brine into the oil without exposure to the atmosphere or other intermediate medium. By this mode of procedure marked economical advantages are derived by obviating the risk of warping and breaking, and remarkable improvements are obtained in the quality of articles hardened.

I may carry on the process continuously by means of apparatus actuated by suitable power and having an especial adaptation to the practice of my invention; but as this apparatus forms the subject-matter of a separate

concurrent application filed by me of even date herewith no description thereof is necessary in this specification.

It will be understood that I do not confine myself strictly to brine and oil, as other quick and slow cooling liquids of different specific gravity may be substituted in the process.

Having thus described my invention, what I claim is—

- 10 1. The process of hardening steel, consisting in plunging the heated article into brine and transferring it from the brine directly into oil without intermediate exposure, substantially as set forth.
- 15 2. The process of hardening articles of steel, consisting in plunging said articles into a

compartment filled with a quick-cooling medium and transferring them while still submerged therein into an adjacent communicating compartment and into a medium of less specific gravity floating upon the medium common to both compartments and having slower-cooling properties, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 19th day of August, A. D. 1891.

GEORGE F. SIMONDS.

Witnesses:

HARRIS C. HARTWELL,
CHARLES F. RICHARDSON.