

UNITED STATES PATENT OFFICE.

SAMUEL W. ETCHELL, OF WEATHERLY, ASSIGNOR TO HIMSELF, D. L. EATON,
OF SAME PLACE, AND ANNIE E. ALLEN, OF PHILADELPHIA, PA.

IMPROVEMENT IN PROCESSES OF HARDENING STEEL.

Specification forming part of Letters Patent No. 134,872, dated January 14, 1873.

To all whom it may concern:

Be it known that I, SAMUEL W. ETCHELL, of Weatherly, Carbon county, Pennsylvania, have invented a Process of Hardening Steel, of which the following is a specification:

The object of my invention is to make steel intensely hard without rendering it brittle; and this object I attain by treating it with borax or caustic alkali, or their equivalents, and mercury, in the manner which I will now proceed to describe.

I heat the tool or other object of steel until it is of a bright red color, and then roll the portion to be hardened in pulverized borax; or I apply the latter to the heated steel in any other convenient manner, after which the steel may be again heated, and the operation may be repeated several times, although in most cases one application of the borax will suffice. After this treatment, and while the steel is red hot, I plunge as much of it as is required to be hardened into a bath of mercury, which renders the steel intensely hard without imparting to it the brittle character which

results from plunging heated steel into water.

A preparatory treatment of the hot steel with caustic alkali will render the steel somewhat harder than the borax treatment. Other alkaline substances may be employed for the preparatory process in place of borax or caustic alkali; but I have found the latter to be particularly effective, so much so that by its aid and by the mercury bath, I have rendered drilling-tools hard enough to bore holes through ordinary files.

I claim as my invention—

The process of hardening steel by treating the same with borax, or its equivalent, and mercury, as set forth.

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

SAMUEL W. ETCHELL.

Witnesses:

J. PATTON MOORE,
JOHN F. DAVIS.