

UNITED STATES PATENT OFFICE.

GEORGE J. FARMER, OF BIRMINGHAM, COUNTY OF WARWICK, ENGLAND.

IMPROVEMENT IN HARDENING IRON AND STEEL.

Specification forming part of Letters Patent No. 19,836, dated April 6, 1858.

To all whom it may concern:

Be it known that I, GEORGE JAMES FARMER, of Birmingham, in the county of Warwick, machinist, a subject of her Britannic Majesty, have invented Improvements in Hardening Iron and Steel; and I do hereby declare that the following is a full and exact description of my said invention—that is to say:

My invention consists in the employment of certain chemical agents, hereinafter more particularly defined, for the purpose of hardening, after they have been cut or otherwise formed, articles of iron or steel—such, for instance, as dies for stamping, press-tools, lathe-chocks, files, certain kinds of cutting-tools, the journals, bearings, and axle-boxes of running machinery, and all other similar articles or parts of machines the form, mode of manufacture, bulk, or weight of which would not prevent them from being subjected with facility to the treatment hereinafter described, and which is as follows: I take ferro-cyanide of potassium, (the prussiate of potash of commerce,) hydrochlorate of ammonia, (the sal-ammoniac of commerce,) and nitrate of potash, (the saltpeter of commerce,) each in equal proportions, or thereabout, reduce them to a fine powder, and thoroughly incorporate them together. I then prepare a bath by mixing the following proportions, or thereabout, of these several ingredients in cold water, namely: the prussiate of potash, two ounces; saltpeter, two ounces, and sal-ammoniac, four ounces, to every gallon of water. Having thus prepared these compounds, the first in the form of a fine powder and the second as a bath, I heat the article I am operating upon in a furnace or other fire until it has attained a red heat. I then remove it from the fire, and, if it be of a size and weight susceptible of such handling, I roll it in the dry powder, as already described, until every portion of the article shall have taken up a sufficient quantity of the mixture, or until all such portion of the article as I may require to be hardened shall be covered with the powder, which, when in contact with the heated metal, becomes immediately fused. I then plunge the article into the bath before described, where it is to be left until cold. When taken out it, will be thoroughly hardened, and not only on the surface, as in case-hardening, but through the en-

tire substance, unless the article be of considerable dimensions.

Thus far my description would apply to the treatment of such masses as could readily be turned or moved about by manual labor. For larger bodies, and such as must be raised and moved by mechanical appliances, instead of rolling them over when hot in the dry composition, which would be impracticable or difficult, I cover the mass of heated metal with the powder by employing a vessel with a perforated or colander top, from which I sift the mixture over the article under treatment, covering the surface thereof, or such portions of the surface which I may require to harden, with a thin coating of the powder, after which the immersion in the bath is to follow, as already particularized. Should it be requisite to reconvert any article thus hardened for the purpose of sharpening, facing up, or for any other operation which in its hardened state it will not admit of, this operation can be readily effected by subjecting the article to heat under a tolerably strong blast, after which it can be cut or faced at pleasure, and subsequently rehardened to fit it for use.

I would remark that I am well aware that a process has long been known of hardening iron and steel while in course of manufacture by the introduction of the ferro-cyanide of potassium (the prussiate of potash) into a molten mass of metal, or, as it is generally termed, "physicking" the metal; but as this, of course, renders the formation of tools or other articles from such metal more laborious and costly, it is utterly inapplicable to effect the result which is attained by my invention. I am also aware that the same agent—namely, the prussiate of potash—has been long employed for case-hardening the surfaces of rolls to give them a steely face, but used alone and without the other ingredients I have named. By my process the metal will be indurated to a considerable depth, and I am consequently enabled to mold or otherwise shape an article into the desired form while the metal is tractable and easy of manipulation. Many things may therefore be manufactured in cast-iron—such as dies or other press or stamping tools, files, rasps, lathe-chocks, and such like articles—and I am enabled to cut, plane, or finish them in any way I please while in the soft state; and after be-

ing subjected to the process herein described they will present all the appearance of cast-steel, will be equally hard and durable, present as fine a surface, and for most practical purposes will prove as useful, while a considerable economy in cost of manufacture will be effected.

Having thus described the nature of my said invention, and in what manner the same is to be practically carried into effect, I wish it to be understood that I do not confine myself to these precise details, nor to the exact proportions of the several chemical compounds herein stated, as I have merely specified those details and proportions which I have hitherto found the best suited to effect the intended purpose, and they may probably admit of some

slight variation when operating upon different qualities of metal.

What I claim, and desire to have secured to me, is—

The hardening of articles formed of iron or steel by plunging them into a solution of prussiate of potash, sal-ammoniac, and saltpeter after they have been heated red-hot and rolled in a powder mixture of the same materials, as set forth.

GEORGE JAMES FARMER.

Witnesses:

EDWARD JOHN PAYNE,
Patent Agent, Birmingham.

I. M. G. UNDERHILL,
C. A. United States of America.