UNITED STATES PATENT OFFICE.

FRANK H. FARMER, OF CLEVELAND, OHIO, ASSIGNOR TO THE WHITE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

PROCESS OF MAKING HARDENED STEEL GEARS.

1,152,157. Specification of Letters Patent. Patented Aug. 31, 1915.

No Drawing. Application filed October 31, 1913. Serial No. 798,406.

To all whom it may concern:

Be it known that I, FRANK H. FARMER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Processes of Making Hardened Steel Gears, of which the following is a full, clear, and exact description.

The object of this invention is to produce substantially hardened steel gears,—that is to say, hardened steel gears which are as nearly perfect in shape as it is possible to make unhardened gears on up-to-date gear cutting and boring machines,—and to do this without subjecting the otherwise finished and hardened gears to a final grinding operation.

In carrying out the invention the gears are not subjected to any separate treatment or process step which is new *per se*. The invention resides in the subjection of the gears to a succession of old treatments or process steps carried on in a definite new order, as hereinafter described and set forth definitely in the claim.

In carrying out the invention the steel gear blanks are rough machined. This is a well understood shop term, and signifies that the gears are bored and cut in suitable machines, so that the teeth are thicker, and perhaps less accurately shaped, and the bore is smaller than required to be on finished gears. After the gear blanks have been thus rough machined, they are subjected to the carbonizing treatment. This treatment and the manner of carrying it out and the results upon the steel produced by it are so well understood that no description of it is necessary in the specification. After the gears have been carbonized they are subjected to an oil treatment for hardening them, which is also old when considered by itself. The treatment specifically consists in heating the gears to about 860° centigrade, and quenching in oil. During both the carbonizing treatment, and the oil treatment the gears will be warped and distorted to a considerable degree. In fact, in the commonly practised method of making hardened steel gears, the gears are carbonized and oil treated after, and only after the final finishing machine work on them has been completed; and it is because these two treatment steps do warp and distort the gears that it has been found necessary to subsequently grind the gears to perfect them and render them suitable for use. The next step in my process is to anneal the carbonized and hardened rough machined gears. The treatment step of annealing is so well understood as to require no description here. The result is to draw the temper and so soften the metal that it can be cut and bored in suitable machines. Next the annealed gears are machine finished. This is a well understood shop term, and signifies that the gear teeth are accurately cut to the required size and shape, and the bore is accurately bored to size and shape. The final step is to harden the machine finished gears by heating them to about 740° to 750° centigrade, and quenching in oil. This final hardening treatment step does not cause any warping or distortion of the accurately shaped machine finished gears. All tendency of the metal to warp or get out of shape seems to have been removed by the previously mentioned steps of carbonizing and oil treating. Micrometer measurements of the finally hardened gears fail to show any change in the size or shape of any of the parts of the gears as compared with the same parts after the gears were machine finished, and before they were hardened.

Having thus described my invention, what I claim is:

The herein described method of producing hardened steel gears which consists first in rough machining the gear blanks, second, in carbonizing the rough machined gears, third, in heating the carbonized gears and quenching them in oil, fourth, in annealing the oil treated gears, fifth, in machine finishing the annealed gears, and finally in oil hardening the machine finished gears.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

FRANK H. FARMER.

Witnesses:

THEODORE R. DAHL,

J. M. MAHON.