

UNITED STATES PATENT OFFICE

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METAL-HARDENING PROCESS

No Drawing.

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This invention relates to improvements in the process of case-hardening articles and has for its object to provide an efficient method of case-hardening portions only of articles and save a very substantial part of the time and amount of labor heretofore required in case-hardening portions of articles.

For certain classes of work it is desirable, when case-hardening articles, to leave a portion or different portions of the articles relatively soft. In order to manufacture articles of which portions only are case-hardened and the remaining portions are relatively soft, various expedients have been heretofore proposed to prevent penetration at the desired soft portion of the article by the hardening ingredient derived from the compound or bath employed in case-hardening. Probably the expedient most widely used heretofore, comprised copper plating the article portions to remain relatively soft, preparatory to case hardening, and removing the copper-plating after the case hardening operation.

This prior method was not only cumbersome, but in order to render the desired portions of the article efficiently impervious to the hardening material, it was necessary to copper plate said portions of the article to a thickness of approximately .003 of an inch or more, involving a plating period of from 45 minutes to an hour. Furthermore, in a large number of instances, dependent of course upon the function of the article, the increased size of the article due to the copper plating necessitated removal of the copper plating after the hardening was completed. This involved a still further waste in time and labor.

According to the present invention, a relatively thin coating of chromium is plated upon the article at the portion of the article to be rendered impervious to the hardening element of any of the usual case-hardening operations. It has been determined by experiment that chromium plating is so impervious to the hardening element that the chromium coating is highly efficient even with a film thickness of between .00005 and .00006 of an inch. It will be appreciated that this slight increase in thickness of the article is negligible for all ordinary purposes and

therefore the present process obviates removal of the coating subsequently to case-hardening.

Not only is it unnecessary to subsequently remove the coating of chromium, but the application of the coating of chromium involves only a small fraction of the time consumed in applying the necessary coating of, for instance, copper. It has been found by experiment that with a chromium plating solution temperature of from 100° to 113° Fahrenheit and a current density of about 150 amperes per square foot, a thoroughly efficient coating or film of chromium of approximately .00006 of an inch in thickness is applied to the article in from five to ten minutes, the average chromium plating time being about 8 minutes, instead of approximately the hour of plating time required in the same operation with, for instance, copper. However, if it is desired for any reason to remove the chromium plating this may be effected in a fraction of the short time required for the plating and without pitting or scarring the article, as frequently occurs upon removal of the copper-plating.

The chromium plating may be effected electrolytically in any well known manner by applying to portions of the article to be later case-hardened any suitable lacquer or similar material which repels chromium plating, before the article is placed in the plating bath. After the article has been plated at the desired portions thereof with the relatively thin coating of chromium, the article is removed from the plating bath and the chromium-repelling lacquer is suitably removed. The article is then ready for case-hardening in any usual manner, as for instance, by carburization with any of the ordinary compounds or by the cyanide process, the chromium plating being effective in any of the usual methods of case-hardening.

The thin coating of chromium being efficiently impervious to the hardening element it is apparent that the chromium-plated portion or portions of the article will be left relatively soft upon the completion of the case-hardening operation.

Having thus set forth the nature of the invention, what we claim herein is:

1. The process of case-hardening a portion only of an article, comprising plating the portion of the article to be left unhardened with a thin coating of chromium whereby the plated portion is not materially increased in size, and then subjecting both plated and unplated portions of the article to the hardening operation, whereby to case-harden the unplated portion of the article.

2. In the process of case-hardening, that step comprising subjecting to the hardening operation an article of which a portion thereof is plated with chromium to a thickness of approximately .00006 of an inch, whereby the unplated portion remaining of the article is hardened.

In testimony whereof, we have signed our names to this specification.

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