

UNITED STATES PATENT OFFICE.

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MACHINE PART.

No Drawing.

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This invention relates to steel parts, and is especially useful for crank shafts, ball bearings, gears, and similar machine parts, where great strength of the piece, as a whole, and a superior wearing surface are desired.

The nature, objects, and advantages of the invention will be best understood from the following:

It has long been known and practiced to case harden certain steel parts, but, because of certain limitations well understood in the art, it has not been found possible to case harden other steel parts, particularly such steel parts as should combine great strength with resistance to wear. It has also been known that, instead of case hardening, the hardening of the steel may be brought about by what may be termed "hardening with nitrides." An example of this type of hardening is disclosed in the United States patent issued to Adolf Fry, No. 1,487,554, dated March 18, 1924, and there is a somewhat similar disclosure in the "Iron Age" of August 5, 1926, pages 340 and 341. Reference may be had to these for the advantages incident to nitride hardening.

Heretofore, however, the application of nitride hardening has been limited to special steels, particularly such as employ aluminum as an alloying ingredient, it apparently having been deemed essential that aluminum be embodied in the steel to make this process of hardening suitable. The field of use of such special steels is, of course, limited.

In accordance with my invention, I propose a steel for nitride hardening which is capable of a wide field of usefulness, and which will combine superior physical properties of the core with superior surface wearing hardness. To this end I provide a molybdenum-chrome steel, a molybdenum, a

chrome-molybdenum steel, and nitride hardened the same. I find that the molybdenum and the chrome have a great capacity for absorbing the nitrogen, and, therefore, give a very fine hardened surface. At the same time, the core of such a steel piece is characterized by the superior physical properties attainable by the employment of such alloying ingredient or ingredients on account of its high drawing "limit." It will thus be seen that a new field is opened for the use of nitride hardening, and that, in consequence thereof, it is now possible to readily provide a superior product for a wide range of machine parts.

In carrying out the invention, I form the piece from an alloy steel, such as above mentioned, machine the portions thereof necessary to be machined, and heat the piece at a temperature below that at which dissociation of the highest nitride of iron can occur, and, consequently, at one well below that at which distortion may occur, in the presence of ammonia, or preferably in the presence of ammonia and an amine. If it is not desired to have the nitrides formed over the whole piece, I protect the pieces in the regions desired by coating them, for example, with a readily removable coating, such as copper, or a coating of paint composed of any material resistant to nitrogen.

I claim:—

1. As a new article of manufacture, a machine part composed of chrome-molybdenum steel having a nitride hardened surface.

2. As a new article of manufacture, a machine part composed of steel embodying chrome and molybdenum, and substantially free from aluminum, said part having a nitride hardened surface.

In testimony whereof I have hereunto signed my name.

CHILD HAROLD WILLS.