

1

2,838,430

METHOD OF PRODUCING AN ANTI-GALLING SURFACE UPON A TITANIUM ARTICLE

Henry J. Argenta and Joseph L. Johnston, Detroit, Mich.,
assignors to Ford Motor Company, Dearborn, Mich.,
a corporation of Delaware

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This invention is concerned with the heat treatment of titanium or titanium base alloys and more specifically with a heat treatment of these metals which will produce a surface having a high resistance to galling when operated under sliding friction without lubrication and which will have superior resistance to impact at atmospheric and low temperatures.

To accomplish this heat treatment the only equipment necessary is a conventional molten salt bath capable of operating at temperatures up to 1625° F. and an oil quenching apparatus. The operation of this invention is dependent upon the production of a thin surface layer of barium titanate upon the titanium piece to be treated. Such surface may be produced by contacting the piece to be treated with a molten salt bath at elevated temperature, such salt bath containing as an essential ingredient a salt of barium. While the invention is by no means so limited, it may readily be practiced with ordinary commercial cyaniding baths, care being taken to choose one having a substantial concentration of barium salts.

A finished or semifinished titanium part is first treated by immersing it in any suitable barium-rich molten salt bath maintained at a temperature of 1575° to 1625° F. for a period of from five to forty minutes. As will be apparent to those skilled in the art, the use of a higher temperature will be associated with a shorter period of immersion and conversely a lower temperature will require a longer period of immersion. The piece is taken from the molten salt bath and quenched directly into oil.

This heating and quenching operation is followed by a second heating in a molten salt bath at a temperature of from 1025° to 1075° F. for a period of from five to forty minutes. Again high temperatures will usually be associated with a shorter time of treatment and lower temperatures with a longer time of treatment. The piece is removed from this second salt bath and permitted to cool in air.

As an example of a specific cycle, cylinder pins and gas pistons for automatic weapons have been heat treated according to the following procedure:

- (1) Immerse in a barium-rich cyanide bath at 1600° F. for twenty minutes.
- (2) Quench directly from the cyanide bath into oil.
- (3) Immerse in a cyanide bath at 1050° F. for twenty minutes.
- (4) Cool in air.

The composition of this barium rich cyanide bath is:

	Percent
Sodium cyanide	35 to 40
Barium chloride	40 to 50
Potassium chloride	5 to 10

2

Pins and pistons so treated and fabricated from an alloy of titanium, iron and chromium known commercially as T1 150 A have exhibited excellent anti-galling properties when run unlubricated against hardened steel.

- 5 Alloy T1-150-A is defined in Handbook on Titanium Metal, edition No. 7, published by Titanium Metals Corporation of America in 1950. On pages 13 and 14, this alloy is defined as a titanium base alloy containing 1½% iron, 2.7% chromium, not over 0.35% oxygen,
- 10 not over 0.10% nitrogen, not over 0.02% tungsten and not over 0.07% carbon. The impact properties of these pieces have been excellent. It is to be understood that the specific heat treating cycle and molten bath composition given above are given by way of an example and that those skilled in the art will be able to make numerous substitutions without the exercise of any invention.

We claim as our invention:

1. The process of producing an anti-galling surface upon a titanium article comprising immersing the article in a barium-rich molten salt bath maintained within the temperature range of 1575° to 1625° F. for from five to forty minutes, directly quenching the article in oil, immersing the quenched article in a molten salt bath within the temperature range of from 1025° to 1075° F. for from five to forty minutes, removing the article from the molten salt bath and cooling the article in air.

2. The process of producing an anti-galling surface upon a titanium article comprising immersing the article in a barium-rich molten salt bath maintained at a temperature of approximately 1600° F. for twenty minutes, directly quenching the article in oil, immersing the quenched article in a molten salt bath maintained at a temperature of approximately 1050° F. for twenty minutes, removing the article from the salt bath and cooling the article in air.

3. The process of producing an anti-galling surface upon a titanium alloy containing minor additions of chromium and iron comprising immersing the article in a barium-rich molten salt bath maintained at approximately 1600° F. for twenty minutes, directly quenching the article in oil, immersing the quenched article in a molten salt bath maintained at a temperature of approximately 1050° F. for twenty minutes, removing the article from the salt bath and cooling the article in air.

4. The process of producing an anti-galling surface upon a titanium article comprising immersing the article in a molten salt bath comprising 35 to 40% sodium cyanide, 40 to 50% barium chloride, and 5 to 10% potassium chloride and maintained within the temperature range of 1575° to 1625° F. for a period of from five to forty minutes, directly quenching the article in oil, immersing the quenched article in a similar cyanide bath within the temperature range of 1025° to 1075° F. for a period of from five to forty minutes, removing the article from the molten cyanide bath and cooling the article in air.

References Cited in the file of this patent

UNITED STATES PATENTS

2,339,223	Holt	Jan. 11, 1944
2,453,896	Dean	Nov. 16, 1948

OTHER REFERENCES

The Iron Age, April 15, 1943, pages 41-45.