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IRON POWDER FOR MAKING SINTERED IRON ARTICLES

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The present invention is concerned with an iron powder serving to make sintered iron articles characterized not only by their good mechanical resistance but chiefly by their high resistance to wear and tear and by a minimum tendency to corrosion.

According to my invention, such products are obtained, in a remarkable manner, owing to the fact that the iron powder intended to be used for making sintered bodies contains, in admixture therewith, an iron powder analogous but having undergone a preliminary thermal treatment by means of a gas capable of giving off nitrogen, for instance ammonia.

If pure iron powder suitable for powder metallurgy is treated at temperatures ranging from 300 to 450° C. by means of a gas capable of giving off nitrogen at these temperatures, such as ammonia, it is found that the iron powder absorbs nitrogen without its hardness being substantially changed. This method may be called "soft nitriding."

"Soft nitriding," as opposed to "hard nitriding," that is to say hardening by means of a nitriding operation, is not yet well known in the art. The following explanations will therefore be given concerning this method.

The term "soft nitriding" designates a thermal treatment of non-alloyed steels, of technically pure iron and cast iron, by means of gases or salts capable of giving off nitrogen at the temperature of treatment, the surfaces of the above mentioned ferrous metals showing, after this treatment, at most a very small increase of hardness, whereas their resistance to wear and tear has been considerably increased by this treatment and their tendency to corrosion has been practically eliminated. The thermal treatment of the iron powder is advantageously performed in an eddy flow of the gas, at temperatures ranging from 300 to 450° C., the duration of the treatment ranging from 20 to 60 minutes, after which the iron powder contains, mainly in the form of solution, absorbed nitrogen. According to the nature of the iron powder that is used and to the conditions of heating, the treatment may give rise to separations of iron nitride (Fe₃N).

If the powder thus treated is compressed so as to form articles of the desired shape and if these articles are sintered in known manner by heating at suitable temperature, for instance 1050° C., a portion of the absorbed gas which contains nitrogen escapes. The natural inference would be that, as a consequence of such a strong heating, the result of the thermal treatment of the iron powder has been cancelled.

Now, most unexpectedly, it has been found, as a result of a great number of experiments, that this is not the case. On the contrary, the sintered iron articles that are obtained have the above mentioned typical qualities of ferrous metals having undergone soft nitriding.

On the other hand, it was found that the agglomeration by sintering of the iron powder particles had not the quality that can be obtained with the usual iron powders. The cause of this defect is probably due to the fact that the excess of nitrogen containing gas escapes during the sintering process and interferes therewith.

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The invention eliminates this defect by the use of a usual iron powder suitable for the manufacture of sintered iron articles, this powder being characterized by the fact that it contains, in admixture therewith, an iron powder analogous but which has been preliminarily subjected to a thermal treatment by means of a gas capable of giving off nitrogen, such for instance as ammonia. Experiments have shown that this addition may correspond to an amount ranging from 6 to 35% by weight of the total mixture.

By using this mixture of iron powders, it has been found that the nitrogen containing gases which escape from the iron powder portion that had undergone treatment, are absorbed either through diffusion or chemical combination during the sintering operation by the iron particles that had not undergone treatment. In consequence the formation of an excess of free nitrogen which would interfere with the sintering process is prevented.

The sintered iron articles made by means of the powder according to the present invention have, in addition to a good mechanical resistance, a higher resistance to wear and tear, whereas their hardness is reduced; furthermore, they have a good deformability in the cold state and their tendency to corrosion is extremely low.

The metallurgical treatment of the new iron powder according to the present invention does not call for any modification in the known methods. The ratio of the amount of powders treated by means of a gas capable of giving off nitrogen to the amount of untreated iron powder which, as a rule, ranges from 6 to 35 percent by weight of the total mixture, is advantageously determined experimentally in accordance with the requirements to be complied with by sintered iron articles to be manufactured. The amount of treated iron powder to be added advantageously ranges, as an average, from 8 to 12 percent by weight of the total mixture. The addition of copper powder to the iron powder, in order to reduce shrinkage during sintering, may be lower, when using the iron powder according to the invention, than in the case of the known iron powders used for sintering. This addition of copper powder may be made advantageously by chemical coppering, or by coppering by means of vapors, of the treated iron powder used as addition in the mixture.

What I claim is:

1. In a process of producing sintered iron articles, the steps of forming a mass of substantially pure iron powder of suitable character for sintering, contacting a portion thereof constituting about 6-35% by weight of the mass with nitrogen at a temperature of about 300-450° C. to soft nitride the portion, and admixing the soft nitrified portion with the remainder of the mass.

2. A process according to claim 1 wherein about 8-12% by weight of the mass is brought into contact with nitrogen.

3. A process according to claim 1 wherein the portion is brought into contact with nitrogen for about 20-60 minutes.

4. A composition for making sintered iron articles consisting essentially of substantially pure iron powder of suitable character for sintering, about 6-35% by weight of the powder being soft nitrified.

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