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METHOD OF TREATING IRON POWDER

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Fig. 1

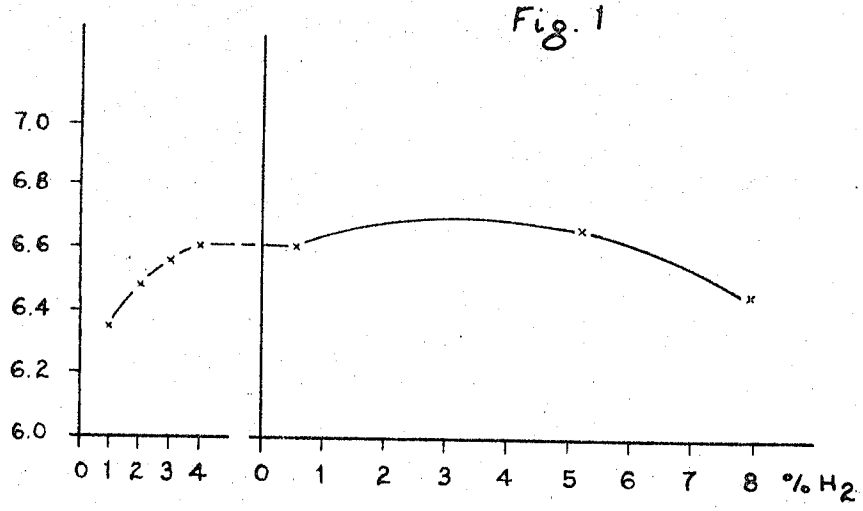
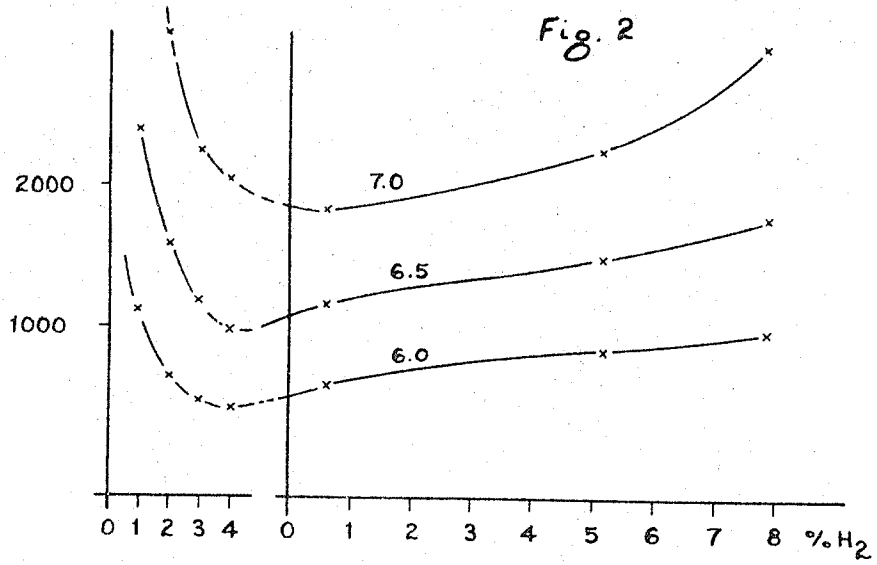


Fig. 2



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METHOD OF TREATING IRON POWDER

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ABSTRACT OF THE DISCLOSURE

The green strength of a reduced iron powder that has been cold-worked to improve its compressibility is increased by first oxidizing the powder to a H_2-loss of 1–10% and then reducing the oxidized powder.

Iron powder having been manufactured by a reduction process at a temperature below the melting point with a subsequent pulverization and sieving is characterized by an irregular particle shape. When such a powder is pressed and sintered to form shaped bodies said irregular particle shape produces a high green strength, that is the strength of the pressed body before having been sintered. If the powder is pressed at a medium pressure, however, it will have a comparatively low compressibility, measured as g./cm.^{3} of the pressed, unsintered body, also called green density. This is, among other things, due to the porosity of the powder.

Efforts have been made of improving the compressibility of such powders by a cold-working process, for instance a rolling process, with a subsequent pulverization to the desired particle size, and annealing to remove the hardening produced by the cold-working. This cold-working process has improved the compressibility but has also reduced the green strength considerably.

Therefore, this invention is concerned with the problem of increasing the compressibility of a porous powder and finding a method for increasing its green strength without significantly reducing the obtained compressibility.

Said problem is solved by subjecting the powder to a limited oxidation after the cold-working process, for instance the rolling process, said limited oxidation being followed by a reduction in hydrogen.

The new method for treating iron powder for increasing the compressibility while maintaining a satisfactory green strength is mainly characterized in subjecting the powder to one or more cold-working processes, for instance rolling processes, if desired separated by annealing processes, pulverizing the powder to the desired particle size, subjecting the powder to an oxidation process until the powder has absorbed a quantity of oxygen corresponding to a so-called H_2-loss of 1–10%, preferably approximately 5%, and reducing the powder in hydrogen.

The H_2-loss is a term used within the iron powder metallurgy to indicate the degree of reduction or the quantity of residual oxygen, and is determined as the loss in weight, in percent, occurring when a powder is annealed in hydrogen at 1050° C. for 60 minutes.

The information will now be described more in detail with reference to an example in which a powder is made

from sponge iron manufactured according to the Hoeganaes method.

The sponge iron is crushed to a particle size below 3 mm. This powder is subjected to a first rolling process. The product from the rolling process consists of substantially coherent strip-shaped portions. This product is crushed, preferably in a disintegrator. The rolling and crushing processes are repeated four times. Samples are taken after each crushing operation.

After the last crushing operation the material was divided into portions, and said portions were subjected to oxidation processes resulting in various values of the H_2-loss, namely 0.55%, 5.24%, and 7.95%. The oxidated portions were reduced in dry hydrogen at 960° C. for 60 minutes. The reduced portions were cautiously pulverized to a particle size of less than 100 mesh, that is less than 0.15 mm. The compressibility of the powders thus produced was ascertained by pressing the powders at a pressure of 4.2 ton/cm.^{2}.

The result is illustrated on the accompanying drawing.

In FIG. 1 the ordinate represents the green density, measured as g./cm.^{3}. The abscissa is divided into two portions. The left-hand portion represents the number of cold-working operations. The right-hand portion represents the degree of oxidation, measured as the so-called H_2-loss.

FIG. 1 clearly shows how the green density increases with the number of cold-working operations, and how it first continues to increase after a mild oxidation-reduction operation, but decreases as a result of an increased oxidation. An oxidation to the H_2-loss of 8% with subsequent reduction produces a compressibility which is equal to that produced after one cold-working operation. Therefore, we prefer to keep the H_2-loss value below 8%.

In FIG. 2 the ordinate represents the green strength, measured as pounds per square inch. The abscissa is divided into two portions similiarly to FIG. 1. The three curves in FIG. 2 represent test bodies having been pressed to various densities, viz. 6.0, 6.5 and 7.0 g./cm.^{3}, respectively. FIG. 2 illustrates the serious decrease in green strength as a result of the rolling operations, and how the green strength can again be increased by a subsequent oxidation-reduction operation.

We claim:

1. Method of increasing the compressibility of a porous cold-worked iron powder and simultaneously increasing its green strength without significantly reducing its compressibility, which comprises oxidizing the powder to an H_2-loss value within the range from 1–10% and then reducing the oxidized powder.

2. Method as defined in claim 1 in which the H_2-loss value of the oxidized iron powder is about 5%.

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