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MOLYBDENUM WHITE IRON CASTING

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The present invention relates to novel and improved white iron castings, cast from a molybdenum iron alloy, which are particularly adapted to withstand abrasion and are extremely tough and hard.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the features of novelty pointed out in the appended claims.

The invention has for its object the provision of improved cast iron rolls of white iron, and castings in other shapes to be subjected to extreme wear, which are hard and tough, are extremely durable and will harden on working. The invention further provides castings of a white molybdenum iron alloy which can be sand-cast and may be used for many purposes for which chilled castings have heretofore been necessary.

In accordance with the present invention, the castings are formed from an alloy having as its essential ingredients the following elements: Iron, carbon, silicon, molybdenum and manganese, which may also contain, if desired, other elements, such as chromium and/or nickel. The carbon content of the alloys of the present invention is preferably fairly high in order to obtain the desired hardness, while the silicon is kept as low as is permitted by the methods of casting, and the manganese content is determined largely by the amount of silicon employed. The percentage of molybdenum contained in the final casting is quite high, and is dependent upon the amount of silicon. If a large amount of silicon is present, the amount of molybdenum used must be considerably increased. Molybdenum increases the toughness of the castings, as well as their hardness and resistance to wear. Chromium may be added in small amounts where some brittleness is not objectionable and it serves to harden the carbides, while nickel is used only in case the castings are to be chilled, and then only for the production of castings having relatively soft centers. When nickel is present in sand castings, the silicon content must be kept low in order to retain the desired hardness and structure of the castings throughout. In general, it is found that molybdenum alloy rolls in accordance with the present invention and having a hardness of 600 Brinell, will wear better than nickel alloy rolls having a hardness of 700 Brinell.

The castings of the present invention are suitable for abrasive parts such as cement mill rolls and shells, coal pulverizers and ore crushing rollers. The castings of the present invention are also well suited to use as rolls for the cold rolling and finishing of various parts where high hardness accompanied by extreme toughness is necessary in order to form a permanent smooth hard surface. These castings may be formed by sand casting, or, if desired, may be chill-cast.

In carrying out the present invention, the molybdenum effects the formation of a white iron having a matrix of sorbite, troostite, martensite, austenite or combinations thereof within a network of carbides. The molybdenum gives the castings an inherent toughness, also rendering them work hardening. Furthermore, the castings are much more easily cast than a material of similar structure containing a high nickel content.

In accordance with the present invention, the castings are preferably formed from an alloy containing from 3.50 to 4.00% carbon, 0.20 to 1.00% silicon, 1.00 to 1.75% manganese, a trace to 1.50% chromium and 3.00% to 4.00% molybdenum, while sulfur and phosphorus are kept to low values. The silicon is preferably kept under 1%, and is as low as is permitted by the methods of casting, considering the shrinkage of the metal and its wildness but in certain cases may be as high as 2.0%. If an austenitic structure is desired, the silicon must be maintained quite low. Manganese may vary from a trace to 2.0% and is used in place of some of the silicon as it is better to kill the heat of the metal being cast because it does not interfere with the structure as does silicon. The amount of chromium is determined by the hardness desired in the carbides, and up to 5.0% may be used where brittleness is not especially to be avoided. The amount of molybdenum employed may be often as low as 2.0%, and if the silicon is maintained at a very low value, the molybdenum may be as low as 1.0%. However, with 2.0% silicon as much as 6% molybdenum may be required. In case the silicon is held at a low value, the molybdenum gives exceptional toughness and wear resistance, and if the molybdenum content is raised it produces an austenitic structure in the alloy.

Nickel may be advantageously employed, up to 6.0%, in accordance with the present invention where it is desired to produce castings having soft centers, and in these cases chilling is necessary to harden the outer surfaces of the castings. In other cases, however, nickel is generally detrimental and necessitates lowering the silicon content of the alloy.