Patented Aug. 26, 1941 2,253,873

UNITED STATES PATENT OFFICE

2,253,873

CHROMIUM-MOLYBDENUM-CARBON ALLOY

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No Drawing. Application June 18, 1941, Serial No. 398,566

5 Claims. (Cl. 75—125)

This invention relates to ferrous alloys capable of being cast, and, more particularly, is concerned with ferrous alloys having high wear resistance and freedom from scale pickup, and, specifically, adapted to form rolls, guides, and the like used to guide or form metal during handling or manufacture.

Prior to my present invention, plugs, guides and rolls of cast steel and of white or gray cast iron have been employed to guide, roll or otherwise shape and handle steel or similar material during the process of manufacture. It is well understood that such cast iron or steel plugs, guides or rolls have a comparatively short life and are very subject to scratches, wear, and deposition of hot scale thereon. Plugs, guides or rolls which are scratched or marred, or have their surface covered with a layer of scale, often objectionably mar the work being guided or rolled. Efforts have been made to treat or harden the plugs, guides or rolls, as by casting them against a chill, or by suitably heat treating the plugs, guides or rolls after casting. Nevertheless, because of brittleness, lack of wear-resistance, or susceptibility to scale deposition, it has been recognized by those skilled in the art that plugs, guides, rolls, or the like adapted to handle metal during its manufacture are subject to considerable improvement.

The heat treating of cast rolls, guides, plugs or other members adapted to form or support metal or other material during the making thereof is a relatively expensive procedure and involves a very high degree of skill. Also, one of the most serious objections to former practices has been the outright failure of the guide, roll or plug in use which has necessitated a complete shutdown of the mill and the repair of the broken part.

Not only have the means for supporting and forming hot or cold metal been unsatisfactory for the reasons set forth above, but also, many of the same difficulties are encountered in handling, shaping, or guiding other materials during the transfer, shaping, handling or manufacture thereof. The same difficulties of lack of wear-resistance or break down in use have been encountered.

It is the general object of my invention to avoid and overcome the foregoing and other difficulties of and objections to known means and materials by the provision of an improved alloy which may be directly cast into members for guiding, forming, conveying, transferring, or otherwise working or handling materials or means, and particularly hot and cold metal, and characterized by wear resistance, lack of susceptibility to metal deposit thereon, inexpensiveness to manufacture, and long life.

Another object of my invention is to provide an improved alloy which may be directly cast to the desired shape, and which without treatment either during casting or afterwards will have a Brinell hardness of more than 600, and which is characterized by extremely high wear resistance.

Another object of my invention is the provision of an improved ferrous alloy characterized by very high stability against change in grain structure and other physical characteristics under heat treatment, and inability to be materially affected by attempted annealing.

The foregoing and other objects of my invention are achieved by the provision of an alloy having between about 1.5 and about 5.0 percent carbon, between about 15.0 and 30.0 percent chromium, between about 1.5 and about 10.0 percent molybdenum, up to about 10 percent copper, and the remainder substantially all iron. The copper content, in general, serves to prevent hot metal deposition and where this is not an important factor the copper may be omitted from the alloy while retaining many of the advantages of the invention.

More particularly, I have discovered that certain distinctive characteristics in the improved alloy are achieved by holding the limits of the alloying ingredients to substantially the following composition: Between about 2.5 and about 5.0 percent carbon; between about 20.0 and about 30.0 percent chromium; between about 2.5 and about 5.0 percent molybdenum; up to about 5.0 percent copper; and the remainder substantially all iron.

One typical heat of the alloy of my invention which possesses the desired characteristics of extreme hardness, long life, high wear-resistance, and lack of susceptibility of scale deposition comprises the following composition: Carbon about 3 percent; chromium about 25 percent; molybdenum about 3 percent; copper about 1.5 percent; and the remainder substantially all iron.

My improved alloy as manufactured in accordance with the last two examples given possesses certain striking and outstanding physical characteristics. First, I have found that even when cast in an ordinary sand mold, and without any heat treating operations of any kind, that my improved alloy has a Brinell hardness of over about 600, and usually has a Brinell hardless of

over 700 and up to about 750 or even greater. Second, one of the most striking characteristics of my improved alloy is that, so far as I have been able to determine, it shows little or no response to heat treatment. Efforts to anneal the alloy have resulted in substantially no change in the hardness of the alloy, and I believe that this is due to the very stable characteristics of the chromium and molybdenum carbides formed in the alloy.

If it is found desirable to provide an alloy retaining many of the advantages already referred to, but, in addition, capable of being annealed and heat treated, then the ingredients of my improved alloy should be kept substantially within the following limits: Between about 1.5 and about 2.5 percent carbon; between about 15.0 and about 20.0 percent chromium; between about 1.5 and about 2.5 percent molybdenum; up to about 5.0 percent copper; and the remainder substantially all iron.

One typical heat of the alloy of my invention which possesses the desired characteristics of hardness, high wear-resistance, and lack of scale deposition, plus the ability to be annealed and heat treated comprises the following composition: Carbon about 2.0 percent; chromium about 16.0 percent; molybdenum about 2.0 percent; copper about 1.5 percent and the remainder substantially all iron.

Although my improved alloy is useful in many relations and wherever wear-resistance or lack of susceptibility to metal or other deposits thereon are important, nevertheless, my invention is particularly adapted to and concerned with the provision of improved means for forming or guiding hot or cold metal during rolling or shaping, and specifically, is concerned with providing rolls for skelp-forming mills or other mills for rolling bars, strips, and shapes of all kinds.

From the foregoing it will be recognized that I have achieved the objects of my invention by providing a castable ferrous alloy which is inexpensive to manufacture, and possesses outstanding characteristics of long life, wear resistance, and freedom from scale pickup.

While in accordance with the patent statutes, I have particularly described my invention, it will be understood that I am not to be limited thereto or thereby, but that the scope of my invention is defined in the appended claims.

I claim:

1. An alloy comprising between about 1.5 and about 5.0 percent carbon, between about 15.0 and about 30.0 percent chromium, between about 1.5 and about 10.0 percent molybdenum, up to about 10 percent copper, and the remainder substantially all iron, said alloy being characterized by a Brinell hardness of over 600 in its cast state and without heat treatment, and by particularly high wear-resistance.

2. An alloy comprising between about 2.5 and about 5.0 percent carbon, between about 20.0 and about 30.0 percent chromium, between about 2.5 and about 5.0 percent molybdenum, up to about 5.0 percent copper, and the remainder substantially iron, said alloy being characterized by a Brinell hardness of over about 700 and by extremely high wear resistance in the cast state, and by a stability of grain structure which renders the alloy substantially unaffected by annealing or heat treating.

3. An alloy comprising about 3 percent carbon, about 25 percent chromium, about 3 percent molybdenum, about 1.5 percent copper, and the remainder substantially all iron, said alloy being characterized by extremely high wear-resistance, and having a Brinell hardness of over about 700 in the cast state.

4. An alloy comprising between about 1.5 and about 2.5 percent carbon, between about 15.0 and about 20.0 percent chromium, between about 1.5 and about 2.5 percent molybdenum, up to about 5.0 percent copper, and the remainder substantially all iron, said alloy being characterized by hardness and wear resistance and by being capable of being annealed and heat treated.

5. An alloy comprising about 2.0 percent carbon, about 16.0 percent chromium, about 2.0 percent molybdenum, about 1.5 percent copper, and the remainder substantially all iron, said alloy being characterized by a Brinell hardness of over about 700 after heat treatment and by high wear-resistance and freedom from scale pickup.

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