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FERROUS ALLOY

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4 Claims. (Cl. 75-126)

This application is a division of my copending application Serial No. 239,021, filed November 5, 1938; and relates to ferrous alloys and more particularly to cast iron compositions which have very good properties as regards wear resistance. The alloys in accordance with the present invention possess resistance to scoring characteristic of cast iron and have extra good properties as regards resistance to wear under severe conditions.

The alloys of the present invention are especially adapted for such parts as cylinder liners, piston rings, pistons, valves, valve guides, tappets, bearings and other parts ordinarily subjected to wear.

The alloys of my invention are composed of the following essential constituents in approximately the proportions stated: 2.25-4.00% carbon, 1.50-3.50% silicon, .05-.60% titanium, .60-1.25% phosphorus, .30-1.00% manganese, balance iron. Ordinary impurities such as sulphur, etc., are present in minor amounts. For example, the sulphur will ordinarily be present from a trace up to .12% and in some cases may be present in slightly higher amounts, say up to .20%. In any case the impurities are such as not to unduly retard the beneficial effects of the essential constituents.

A preferred narrower range of the essential constituents is as follows: 2.75-3.75% carbon, 2.00-3.20% silicon, .10-.45% titanium, .65-1.10% phosphorus, .40-.80% manganese, balance iron.

In the applications of my invention claimed herein chromium within the range .50-2.00% is present.

The alloys of my invention, in addition to being score and wear resistant, are ordinarily comparatively easy to machine. It will be understood by those skilled in the art that the carbon and silicon content may be modified within the ranges given to suit the casting size and/or cooling rate in order to obtain extremely good machinability. It is common knowledge in the field of metallurgy that small castings by reason of their faster cooling rate will have more combined carbon and less graphitic carbon than will castings of large size when both are made of the same chemical composition. Higher combined carbon and less graphitic carbon will make machining more difficult, so that the composition must be modified to compensate for this condition. This may be done by adding more silicon, more carbon, or more of both silicon and carbon.

Within the range of composition given it is possible in certain section sizes to obtain white

irons which would, of course, be difficult to machine.

It has been the general experience that the softer, more easily machined cast irons do not have good properties as regards wear resistance. I have found that cast irons of the compositions given in Examples 1 and 2 below are comparatively quite soft as cast in bars $\frac{7}{8}$ " x $\frac{5}{16}$ " x 12" in green sand molds. These compositions are easy to machine and resist wear extremely well. The compositions of examples 3 and 4 in which chromium is present are not as readily machinable as are the compositions of Examples 1 and 2.

In many instances specific properties in addition to these of wear resistance and score resistance are required. Some of these are: high strength in sections of large sizes, good hardness near the center of large castings, castings which do not leak, cast iron which is easily melted in a cupola, or iron which has good fluidity at ordinary casting temperatures, etc.

Compositions having the essential components in approximately the following proportions have been found by test to have especially desirable properties as regards wear resistance and allow some variation in other desirable physical properties.

Example No. 1

2.94% carbon, 3.18% silicon, .40% titanium, .73% phosphorus, .48% manganese, balance iron.

Example No. 2

3.19% carbon, 2.54% silicon, .40% titanium, .82% phosphorus, .78% manganese, balance iron.

Example No. 3

3.19% carbon, 2.54% silicon, .40% titanium, .82% phosphorus, .78% manganese, .62% chromium, balance iron.

Example No. 4

3.07% carbon, 2.40% silicon, .16% titanium, 1.02% phosphorus, .58% manganese, .90% chromium, balance iron.

The described alloys may be prepared in any suitable manner. As regards titanium, one convenient method of adding the same is in the form of a silicon titanium alloy. Preferably, the titanium is added at a late stage in the melting process in order to avoid excessive oxidation. The silicon may also be added late if desired to obtain an iron of higher strength. Any suitable melting furnace may be used.

I claim:

1. An alloy composed of the following elements

as essential constituents in substantially the amounts stated: 2.25%-4.00% carbon, 1.50-3.50% silicon, .05-.60% titanium, .60-1.25% phosphorus, .30-1.00% manganese, .50-2.00% chromium, balance substantially all iron.

- 5 2. An alloy composed of the following elements as essential constituents in substantially the amounts stated: 2.75-3.75% carbon, 2.00-3.20% silicon, .10-.45% titanium, .65-1.10% phosphorus,
10 .40-.80% manganese, .50-2.00% chromium, balance iron.

3. An alloy composed of the following elements as essential constituents in approximately the amounts stated: 3.19% carbon, 2.54% silicon, .40% titanium, .82% phosphorus, .78% manganese, .62% chromium, balance iron.

4. An alloy composed of the following elements as essential constituents in approximately the amounts stated: 3.07% carbon, 2.40% silicon, .16% titanium, 1.02% phosphorus, .58% manganese, .90% chromium, balance iron.

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