

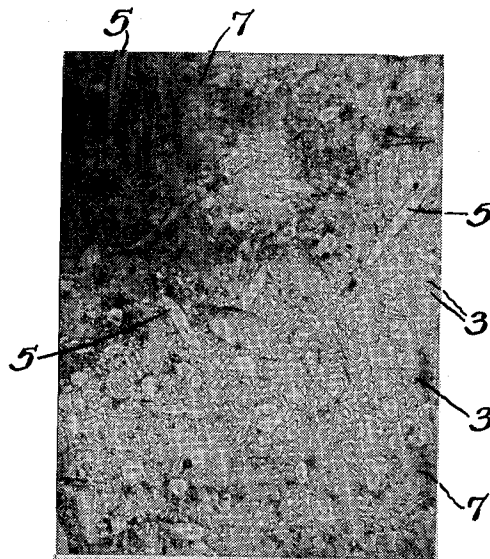
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ALLOY POWDER FOR FLAME SPRAYING

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ALLOY POWDER FOR FLAME SPRAYING

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This invention relates to metal powders for flame spraying and more particularly to iron base alloy powders to be simultaneously flame sprayed and deposited.

Deposits formed by flame spraying, wherein metallic powder is sprayed and fused upon a metal surface are usually applied to metal surfaces to make them hard and wear resistant. Generally the flame spraying process uses an oxy-acetylene flame as a heat source. Iron base alloys are difficult to flame spray effectively because they readily oxidize severely and then do not adequately wet the base metal.

An object of this invention is to provide an iron base powder which can be used to effectively apply flame sprayed, fused deposits that are resistant to wear and especially to abrasion.

Another object is to provide such an alloy that can be deposited with minimum oxidation and with good wetting action on the base metal to be overlaid.

In accordance with this invention, it has been discovered that when mixtures of high carbon iron powder are used in conjunction with cobalt base alloy powders containing specific amounts of boron, the resulting mixture can be deposited satisfactorily with good wetting and minimal oxidation.

The high carbon iron powder is used in an amount between 15 and 70 percent by weight of the total mixture while the cobalt base alloy powder is used in an amount between 85 and 30 percent. The amount of boron contained in the cobalt base alloy on a weight basis is sufficient so that in the total alloy powder composition a percent is maintained between 0.5 and 3.0 percent by weight.

Usually the high carbon iron powder and cobalt base alloy powder are present in relatively small particle size such as below 150 mesh. Practically speaking, there is no lower limit on the particle size of the constituents; however, it is preferred to maintain the high carbon iron powder between 150 and 200 mesh.

By high carbon iron powder is meant iron powder containing from 2.0 to 4.3 percent by weight carbon and preferably from 3.8 to 4.2 percent. A carbon content of 4 percent has been found particularly useful.

By cobalt base alloy is meant an alloy mesh powder containing cobalt as a major constituent and minor amounts of chromium and carbon and preferably containing minor amounts of both chromium and tungsten in addition to cobalt. The cobalt base alloy further contains boron in amount sufficient to provide from 0.5 to 3 percent by weight of the total cobalt base alloy—high carbon iron composition.

As a suitable cobalt base alloy, there may be mentioned the following constituents in the following percents by weight.

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Constituent	Percent by Weight		
	Broad Range	Preferred Range	Example
Cobalt.....	42 to 75.....	45 to 56.....	46.7
Chromium.....	22 to 34.....	28 to 33.....	31.5
Tungsten.....	2 to 20.....	15 to 18.....	17.3
Boron.....	1 to 4.....	1.5 to 2.5.....	2.0
Carbon.....	1 to 3.....	2.25 to 2.75.....	2.5

The following examples are illustrative of two of the mixtures which meet the objectives of this invention:

EXAMPLE 1

	Cobalt Chromium Tungsten Alloy	High Carbon Fe Powder
Weight, percent.....	50-70	30-50
Preferred mixture, percent.....	65	35
Mesh size.....	-150	-150
Preferred mesh size.....	-150	-150+200

EXAMPLE 2

	Cobalt Chromium Tungsten Alloy	High Carbon Fe Powder
Weight percent.....	30-50	50-70
Preferred mixture, percent.....	40	60
Mesh size.....	-150	-150
Preferred mesh size.....	-150	-150+200

The finished composition according to this invention has the following ranges of constituents in the stated percentages on a weight basis:

Constituent	Broad Range, Percent	Preferred Range I, Percent	Preferred Range II, Percent
Iron.....	15-70	30-35	55-60
Carbon.....	1.5-4	2.5-3.0	3-3.5
Tungsten.....	0-15	8-12	6-9
Chromium.....	5-25	18-24	11-15
Boron.....	.5-2.5	1-1.5	0.75-1.5
Cobalt.....	15-40	25-33	17-23

As a particular example there may be mentioned the following formulation:

Constituent:	Percent by weight
Iron .....	32.1
Carbon .....	2.9
Tungsten .....	11.0
Chromium .....	21.9
Boron .....	1.4
Cobalt .....	30.7

The compositions according to the invention have been found to be surprisingly resistant to oxidation during flame spraying. The compositions further show good wetting properties and produce a deposit with a high indentation hardness. Additionally, the deposit shows exceptionally high abrasion resistance in the dry sand abrasion test.

The figure is a photomicrograph of a typical deposit according to this invention. The composition used to

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deposit this coating corresponds to preferred range II of total chemistry as specified above.

The photomicrograph is characterized by a uniform distribution of chromium carbide 5 in a cobalt-iron matrix 7. The matrix hardness is increased by the presence of secondary complex iron-tungsten and iron-chromium carbides 3.

The above deposit shows an indentation hardness of Rockwell C 64 and the micro hardness of the matrix indicates a high hardness of Rockwell C 60 to 62. The deposit shows particularly high abrasion resistance in the dry sand abrasion test.

What is claimed is:

1. An alloy powder composition for flame spraying comprising between 15 and 70 percent by weight of a high carbon iron powder, said high carbon iron powder containing from 2 to 4.3 percent by weight carbon, and between 85 and 30 percent by weight of a cobalt base alloy powder, said cobalt base alloy powder containing the following constituents in the following percents by weight:

Constituents:	Weight percent
Cobalt	42 to 75
Chromium	22 to 34
Tungsten	2 to 20
Boron	1 to 4
Carbon	1 to 3

the amount of boron present in the cobalt base alloy being sufficient to provide from between 0.5 and 3 percent by weight of the alloy powder composition.

2. The alloy powder composition according to claim 1 wherein the particle size of the high carbon iron powder and cobalt base alloy powder is below 150 mesh.

3. The alloy powder composition according to claim 1 wherein the high carbon iron powder is present in an amount between 30 and 50 percent by weight and the cobalt base alloy powder is present in an amount between 50 and 70 percent by weight.

4. The alloy powder composition according to claim 1 wherein the high carbon iron powder is present in an amount between 50 and 70 percent by weight and the cobalt base alloy is present in an amount between 30 to 50 percent by weight.

5. The alloy powder composition according to claim 1 wherein the cobalt base alloy has the following constituents in the following percent by weight:

Constituents:	Weight percent
Cobalt	45 to 56
Chromium	28 to 33
Tungsten	15 to 18
Boron	1.5 to 2.5
Carbon	2.25 to 2.75

6. The alloy powder composition according to claim 1 wherein the high carbon iron powder contains from 3.8 to 4.2 percent by weight carbon.

7. An alloy powder composition for flame spraying comprising between 15 and 70 percent by weight of a high carbon iron powder, said high carbon iron powder containing from 3.8 to 4.2 percent by weight carbon and between 85 and 30 percent by weight of a cobalt base alloy powder, said cobalt base alloy powder containing the following constituents in the following percents by weight:

Constituents:	Weight percent
Cobalt	45 to 56
Chromium	28 to 33
Tungsten	15 to 18
Boron	1.5 to 2.5
Carbon	2.25 to 2.75

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the amount of boron present in the cobalt base alloy being sufficient to provide from between 0.5 and 3 percent by weight of the alloy powder composition, said high carbon iron powder having a particle size between 150 and 200 mesh and said cobalt base alloy having a particle size below 150 mesh.

8. An alloy powder composition for flame spraying comprising the following constituents in the following percentages by weight:

Constituent:	Percent by weight
Iron	15-70
Carbon	1.5-4
Tungsten	0-15
Chromium	5-25
Boron	.5-2.5
Cobalt	15-40

9. An alloy powder composition for flame spraying comprising the following constituents in the following percentages by weight:

Constituent:	Percent by weight
Iron	30-35
Carbon	2.5-3.0
Tungsten	8-12
Chromium	18-24
Boron	1-1.5
Cobalt	25-33

10. An alloy powder composition for flame spraying comprising the following constituents in the following percentages by weight:

Constituent:	Percent by weight
Iron	55-60
Carbon	3-3.5
Tungsten	6-9
Chromium	11-15
Boron	0.75-1.5
Cobalt	17-23

11. An alloy powder composition for flame spraying comprising the following constituents in the following percentages by weight:

Constituent:	Percent by weight
Iron	32.1
Carbon	2.9
Tungsten	11.0
Chromium	21.9
Boron	1.4
Cobalt	30.7

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